

FCC TEST REPORT

for

SOUNDCAST LLC

Bluetooth and NFC Speaker

Model Number: VG7

FCC ID: SUD-VGBT07A

Prepared for : SOUNDCAST LLC
Address : 9771-E Clairemont Mesa Blvd.San Diego,CA92124

Prepared by : Keyway Testing Technology Co., Ltd.
Address : Building 1, Baishun Industrial Zone, Zhangmutou Town,
Dongguan, Guangdong, China

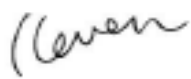
Tel: 86-769-8718 2258
Fax: 86-769-8718 1058

Report No. : 17KWE025059F
Date of Test : Jan. 20~ Feb.10, 2017
Date of Report : Feb. 14, 2017

TABLE OF CONTENTS

Test Report Declaration	Page
1. TEST SUMMARY	4
2. GENERAL PRODUCT INFORMATION	5
2.1. Product Function.....	5
2.2. Description of Device (EUT)	5
2.3. Independent Operation Modes.....	5
2.4. Product Version	5
2.5. Test Facilities	6
2.6. List of Test and Measurement Instruments	7
3. TEST SET-UP AND OPERATION MODES.....	8
3.1. Principle of Configuration Selection.....	8
3.2. Block Diagram of Test Set-up.....	8
3.3. Test Operation Mode and Test Software.....	8
3.4. Special Accessories and Auxiliary Equipment.....	8
3.5. Countermeasures to Achieve EMC Compliance	8
3.6. Test Environment:	8
4. MAXIMUM PEAK OUTPUT POWER.....	9
4.1. Limits	9
4.2. Test Procedure.....	9
4.3. Test setup	9
5. EMISSION TEST RESULTS	15
5.1. Conducted Emission at the Mains Terminals Test.....	15
5.2. Radiated Emission Test.....	20
6. 20DB OCCUPY BANDWIDTH	29
6.1. Limits	29
6.2. Test setup	29
7. FREQUENCY SEPARATION.....	36
7.1. Limits	36
7.2. Test setup	36
8. NUMBER OF HOPPING FREQUENCY	43
8.1. Limits	43
8.2. Test setup	43
9. DWELL TIME	45
9.1. Limits	45
9.2. Test setup	45
10. BAND EDGE COMPLIANCE TEST	52
10.1. Limits	52
10.2. Test setup	52
10.3. TEST Procedure	53
11. ANTENNA REQUIREMENTS	72
11.1. Limits	72
11.2. Result	72

Keyway Testing Technology Co., Ltd.

Applicant:	SOUNDCAST LLC		
Address:	9771-E Clairemont Mesa Blvd.San Diego,CA92124		
Manufacturer:	Gigatek Electronics(DongGuan) Co.; LTD.		
Address:	No.132,DongXing E.Rd., DongXing Industrial VG7, KengMei Village, DongKeng Town, DongGuan City, GuangDong, China		
E.U.T:	Bluetooth and NFC Speaker		
Model Number:	VG7		
Serial Model:	N/A		
Trade Name:	Soundcast	Serial No.:	-----
Date of Receipt:	Jan. 09, 2017	Date of Test:	Jan. 20~ Feb.10, 2017
Test Specification:	FCC Part 15, Subpart C Section 15.247: 2015 ANSI C63.10:2013		
Test Result:	The equipment under test was found to be compliance with the requirements of the standards applied.		
Issue Date: Feb. 14, 2017			
Tested by:  Keven Wu / Engineer	Reviewed by:  Mark Li / Supervisor	Approved by:  Andy Gao / Supervisor	
Other Aspects: None.			
Abbreviations: OK/P=passed fail/F=failed n.a/N=not applicable E.U.T=equipment under tested			
<i>This test report is based on a single evaluation of one sample of above mentioned products. It is not permitted to be duplicated in extracts without written approval of Keyway Testing Technology Co., Ltd.</i>			

1. TEST SUMMARY

Test Items	Test Requirement	Result
Conducted Emissions	15.207	PASS
Radiated Emissions	15.205(a)/15.209 15.247(d)	PASS
20dB Bandwidth	15.247(a)(1)	PASS
Frequency Separation	15.247(a)(1)	PASS
Maximum Peak Output Power	15.247(b)(1)	PASS
Number of Hopping Frequency	15.247(a)(1)(iii)	PASS
Dwell time	15.247(a)(1)(iii)	PASS
Emissions from out of band	15.247(d)	PASS
Antenna Requirement	15.203	PASS

2.GENERAL PRODUCT INFORMATION

2.1. Product Function

Refer to Technical Construction Form and User Manual.

2.2. Description of Device (EUT)

Product Name:	Bluetooth and NFC Speaker
Model No.:	VG7
Frequency Rang	2402~2480 MHz
Modulation type:	GFSK, Pi/4 QPSK, 8DPSK
Channel numbers:	40 channels for BT4.0, 79 channels for BT3.0
Channel separation:	2MHz for BT4.0, 1MHz for BT3.0
Antenna Type:	PCB Antenna
Antenna gain:	4.01dBi
Power Supply:	battery 7.4V
Adapter:	GOLDEN PROFIT ELECTRONICS LTD. MODEL: GPE060D-120500D INPUT: AC100-240V 50/60Hz 1.5A OUTPUT: DC 12V/5000mA 60W

2.3. Independent Operation Modes

The basic operation modes are:

2.3.1. EUT work BT mode and Test mode as below:

Pretest Mode	Description
Mode 1	CH00
Mode 2	CH39
Mode 3	CH78
Mode 4	BT link

2.4. Product Version

Product SW version	V0.8.6
Product HW version	X1R2
Radio SW version	V001B002
Radio HW version	JS-BTM8670-V0.01D
Test SW Version	Blue Test3
RF power setting in TEST SW	3dBm

2.5. Test Facilities

Lab Qualifications : Certificated by Industry Canada
 Registration No.: 9868A
 Date of registration: December 8, 2011

 Certificated by FCC, USA
 Registration No.: 370994
 Date of registration: February 21, 2012

 Certificated by CNAS China
 Registration No.: CNAS L5783
 Date of registration: August 8, 2012

2.6. List of Test and Measurement Instruments

2.6.1. For conducted emission at the mains terminals test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESCI	101156	Apr. 09,16	Apr. 08,17
Artificial Mains Network	Rohde&Schwarz	ENV216	101315	Apr. 09,16	Apr. 08,17
Artificial Mains Network (AUX)	Rohde&Schwarz	ENV216	101314	Apr. 09,16	Apr. 08,17
RF Cable	FUJIKURA	3D-2W	944 Cable	Apr. 09,16	Apr. 08,17

2.6.2. For radiated emission test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESCI	101156	Apr. 09,16	Apr. 08,17
Bilog Antenna	ETS-LINDGREEN	3142D	135452	Apr. 09,16	Apr. 08,17
Spectrum Analyzer	Agilent	E4411B	MY4511304	Apr. 09,16	Apr. 08,17
Spectrum Analyzer	Agilent	N9020A	MY56070279	Apr. 09,16	Apr. 08,17
3m Semi-anechoic Chamber	ETS-LINDGREEN	966	KW01	Apr. 09,16	Apr. 08,17
Signal Amplifier	SONOMA	310	187016	Apr. 09,16	Apr. 08,17
Signal Amplifier	Agilent	8449B	3008A00251	Apr. 09,16	Apr. 08,17
RF Cable	IMRO	IMRO-400	966 Cable 1#	Apr. 09,16	Apr. 08,17
MULTI-DEVICE Controller	ETS-LINDGREEN	2090	126913	Apr. 09,16	Apr. 08,17
Horn Antenna	SCHWARZBECK	BBHA9170	9170-068	Apr. 09,16	Apr. 08,17
Spectrum Analyzer	Agilent	E4408B	MY44211125	Apr. 09,16	Apr. 08,17
High Pass filter	Micro	HPM50111	324216	Apr. 09,16	Apr. 08,17
Constant temperature and humidity box	GF	GTH-800-40-1P	MAA9906-005	Apr. 09,16	Apr. 08,17
Attenuation	MCE	24-10-34	BN9258	Apr. 09,16	Apr. 08,17
Loop Antenna	ARA	PLA-1030/B	1029	Apr. 09,16	Apr. 08,17
Power Meter	Anritsu	ML2495A	1204003	Apr. 09,16	Apr. 08,17
Power Sensor	Anritsu	MA2411B	1126150	Apr. 09,16	Apr. 08,17

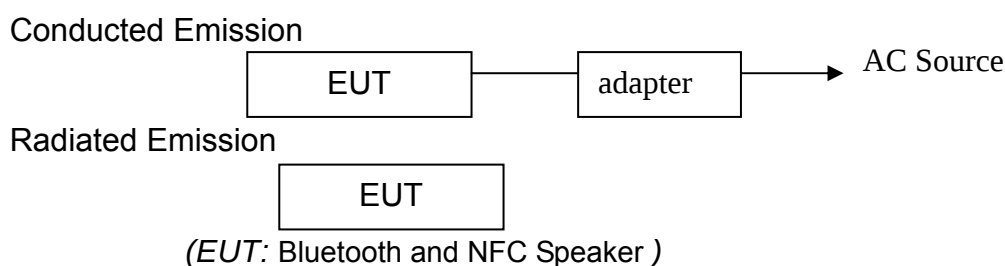
3. TEST SET-UP AND OPERATION MODES

3.1. Principle of Configuration Selection

Emission: The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the Operating Instructions.

3.2. Block Diagram of Test Set-up

System Diagram of Connections between EUT and Simulators



3.3. Test Operation Mode and Test Software

Pretest Mode	Description
Mode 1	CH00
Mode 2	CH39
Mode 3	CH78
Mode 4	BT link

Test Software: e3 and bluetest3

3.4. Special Accessories and Auxiliary Equipment

None.

3.5. Countermeasures to Achieve EMC Compliance

None.

3.6. Test Environment:

Ambient conditions in the test laboratory:

Items	Actual
Temperature (°C)	20~30
Humidity (%RH)	50~65

4. MAXIMUM PEAK OUTPUT POWER

4.1. Limits

For FCC

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247 (b)(i)	Peak Output Power	0.125 w or 20.96dBm	2400-2483.5	PASS

4.2. Test Procedure

For Peak power

- The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
- Spectrum Setting : RBW > the 20 dB bandwidth of the emission being measured
 VBW ≥ RBW
 Sweep = auto
 Detector function = peak
 Trace = max hold

4.3. Test setup

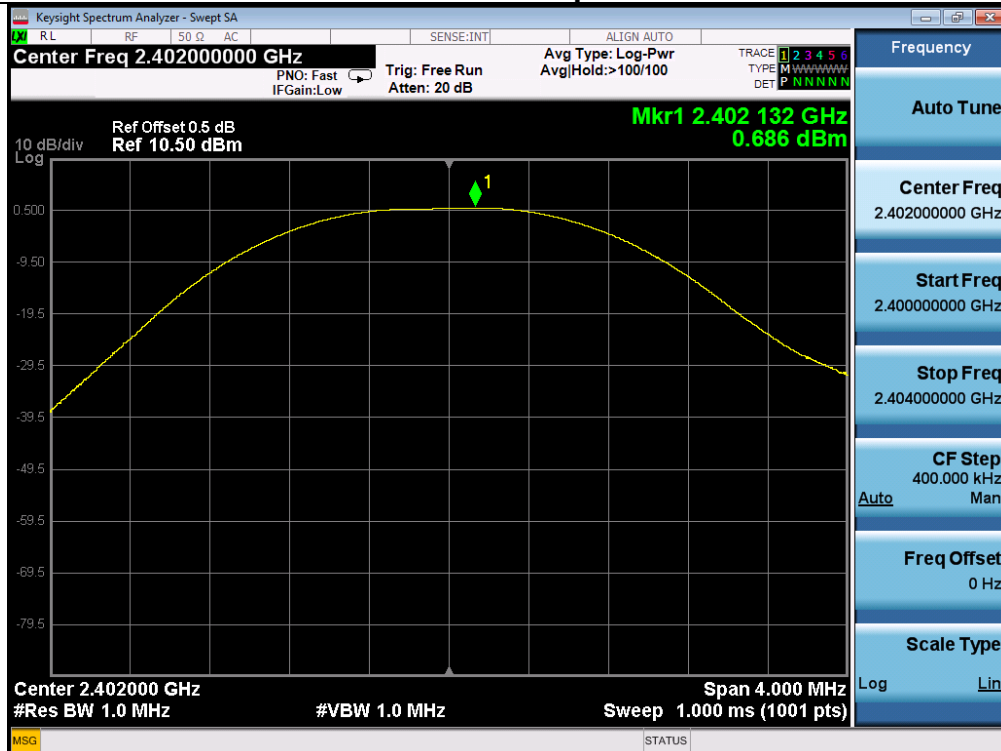
Peak power



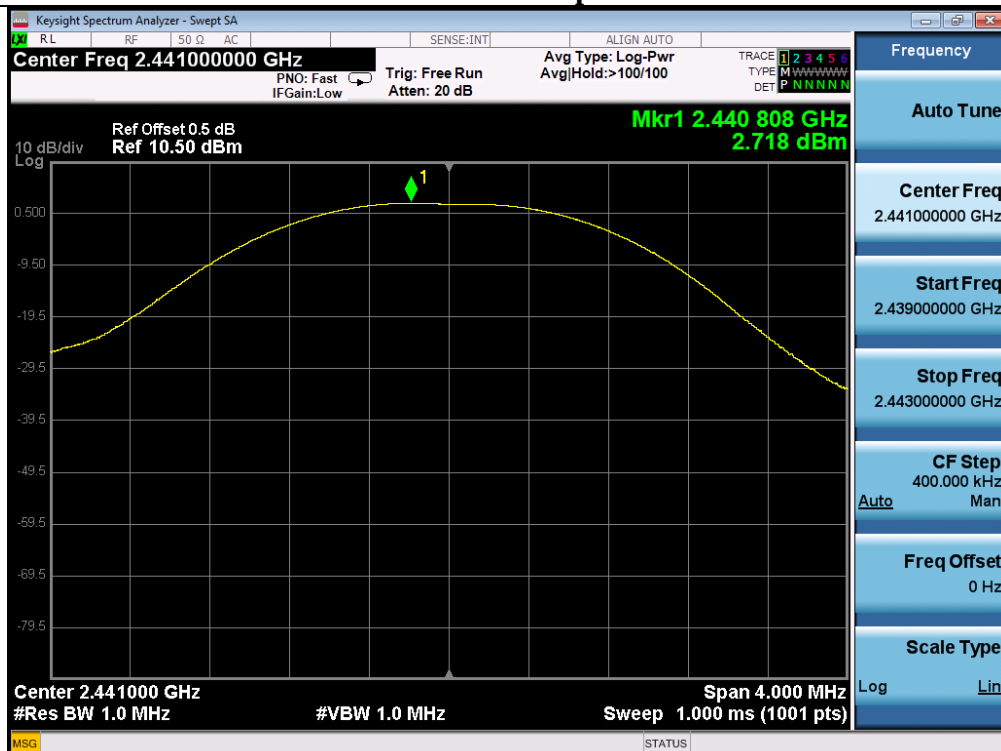
Test data:

	Channel Frequency (MHz)	Peak output Power dBm	Limit dBm
GFSK	2402	0.686	30
	2441	2.718	30
	2480	2.940	30
Pi/4DQPSK	2402	-2.000	20.96
	2441	-2.363	20.96
	2480	-1.399	20.96
8-DPSK	2402	-3.215	20.96
	2441	-2.745	20.96
	2480	-0.439	20.96

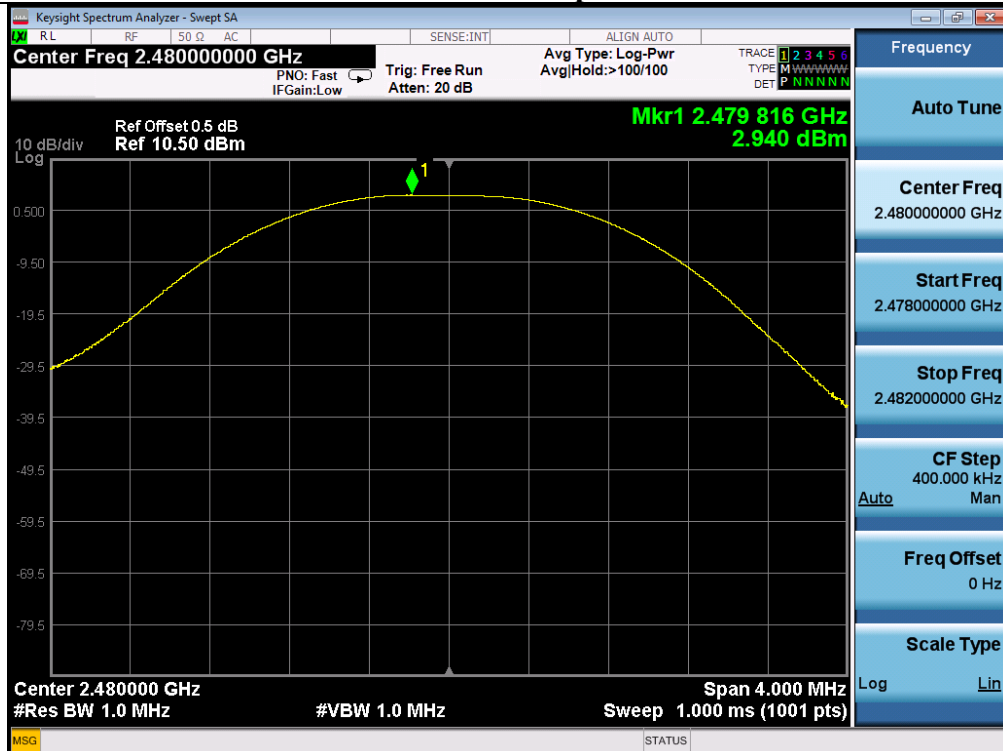
CH00 -1Mbps



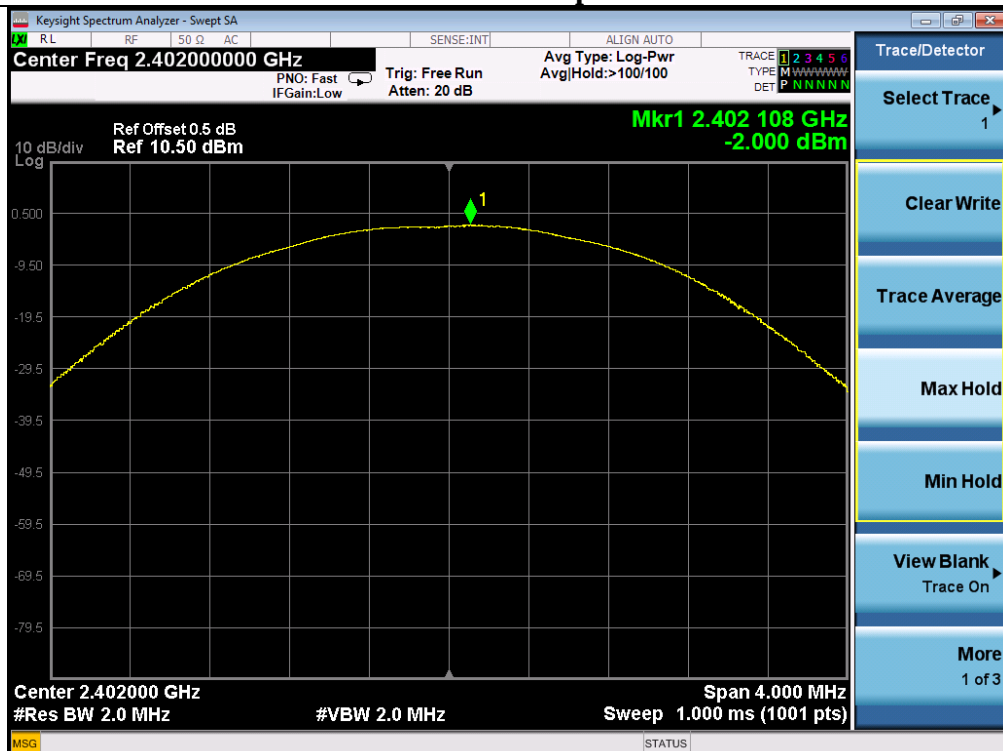
CH39 -1Mbps



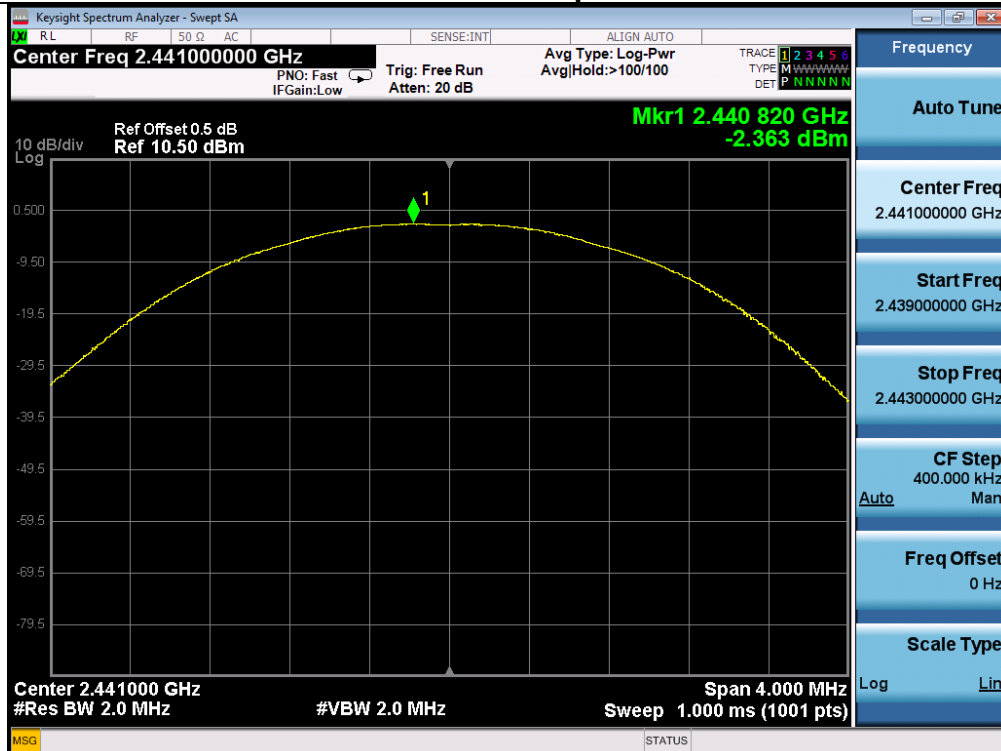
CH78 -1Mbps



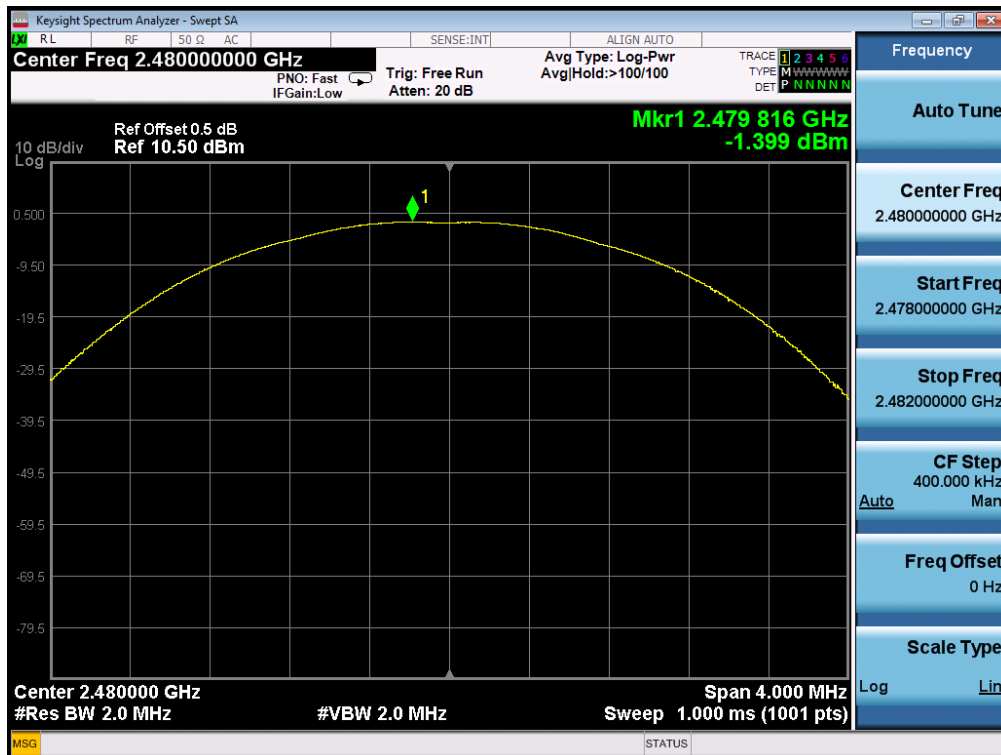
CH00 -2Mbps



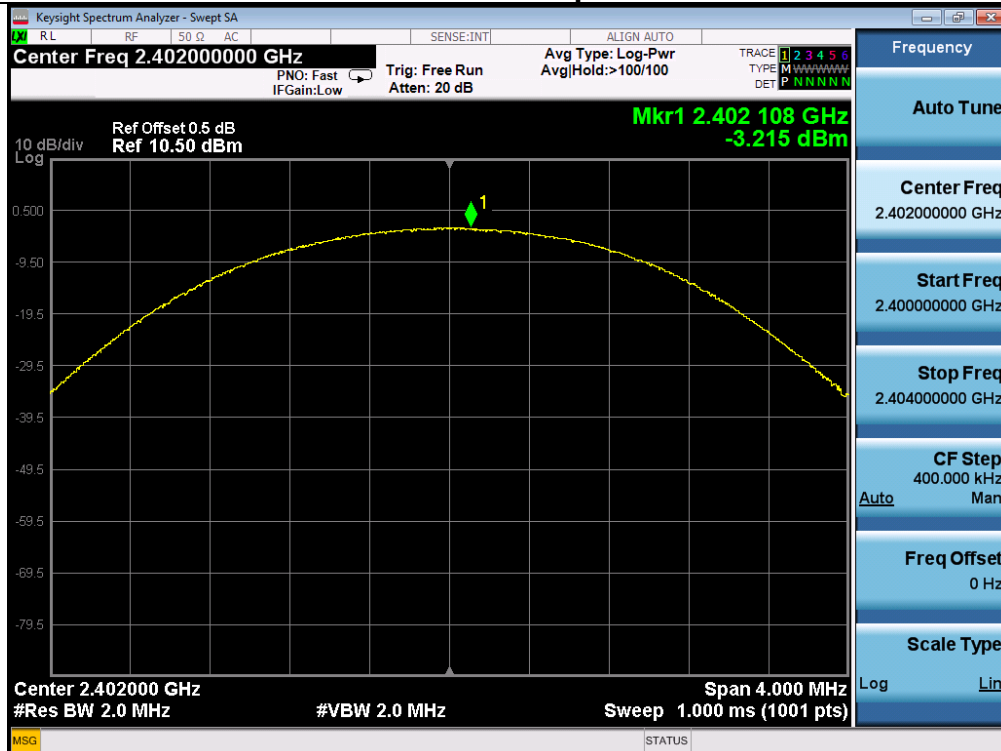
CH39 -2Mbps



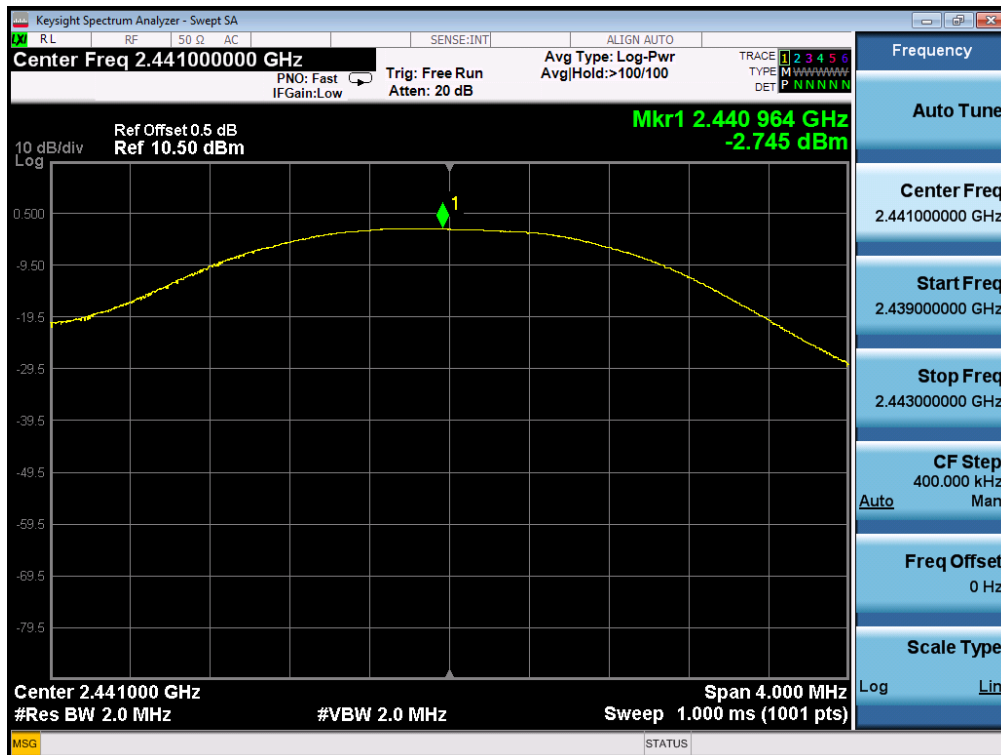
CH78 -2Mbps

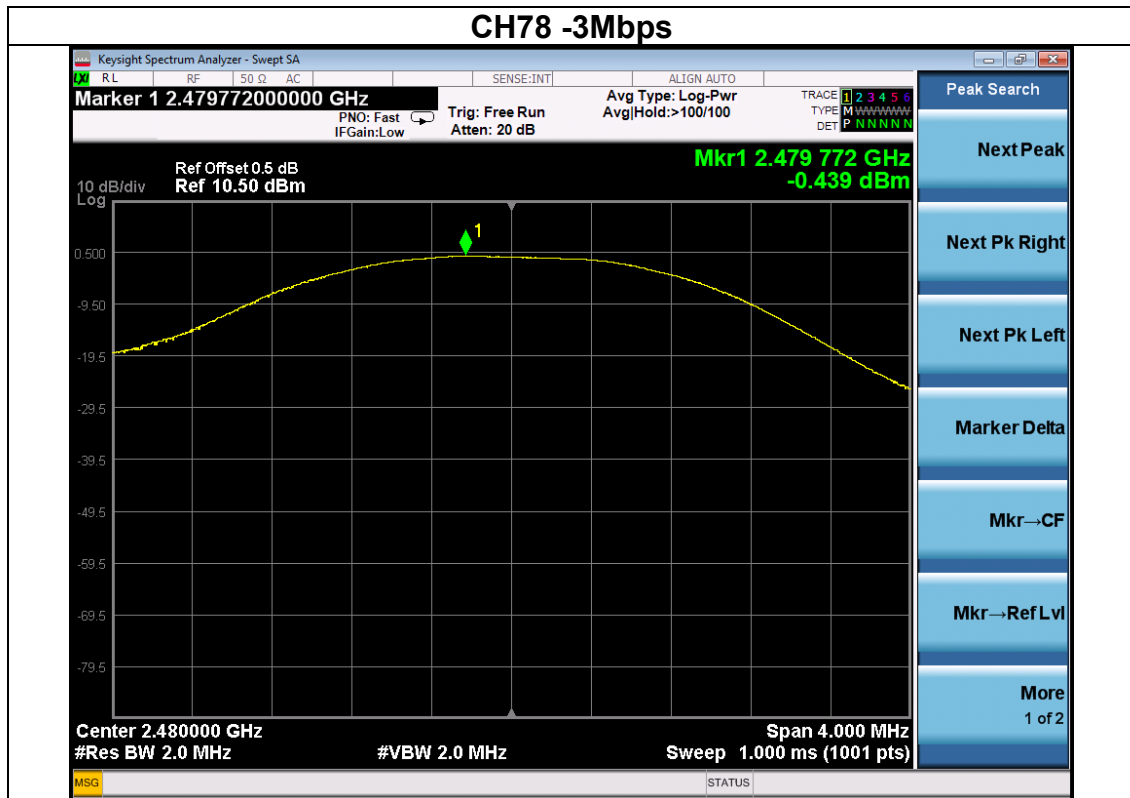


CH00 -3Mbps



CH39 -3Mbps





5. EMISSION TEST RESULTS

5.1. Conducted Emission at the Mains Terminals Test

5.1.1. Limit 15.207

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56	56 to 46
0.5-5	56	46
5-30	60	50

5.1.2. Test Setup

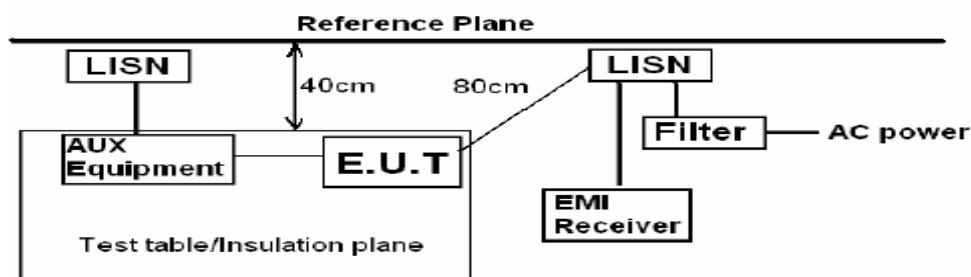
The EUT was put on a wooden table which was 0.8 m high above the ground and connected to the AC mains through the Artificial Mains Network (AMN). Where the mains cable supplied by the manufacture was longer than 0.8 m, the excess was folded back and forth parallel to the cable at the center so as to form a bundle no longer than 0.4 m.

The EUT was kept 0.4 m from any other earthed conducting surface. Both sides of AC line were checked to find out the maximum conducted emission levels according to the test procedure during the conducted emission test.

The frequency range from 150 kHz to 30 MHz was investigated.

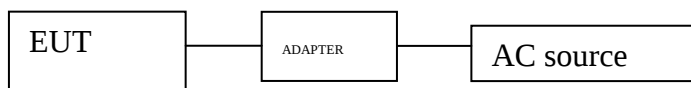
The bandwidth of the test receiver was set at 9 kHz.

Pretest for all mode, The test data of the worst case condition(s) was reported on the following page. We pretest AC 120V and AC 240V, the worst voltage was AC 120V and the data recording in the report.



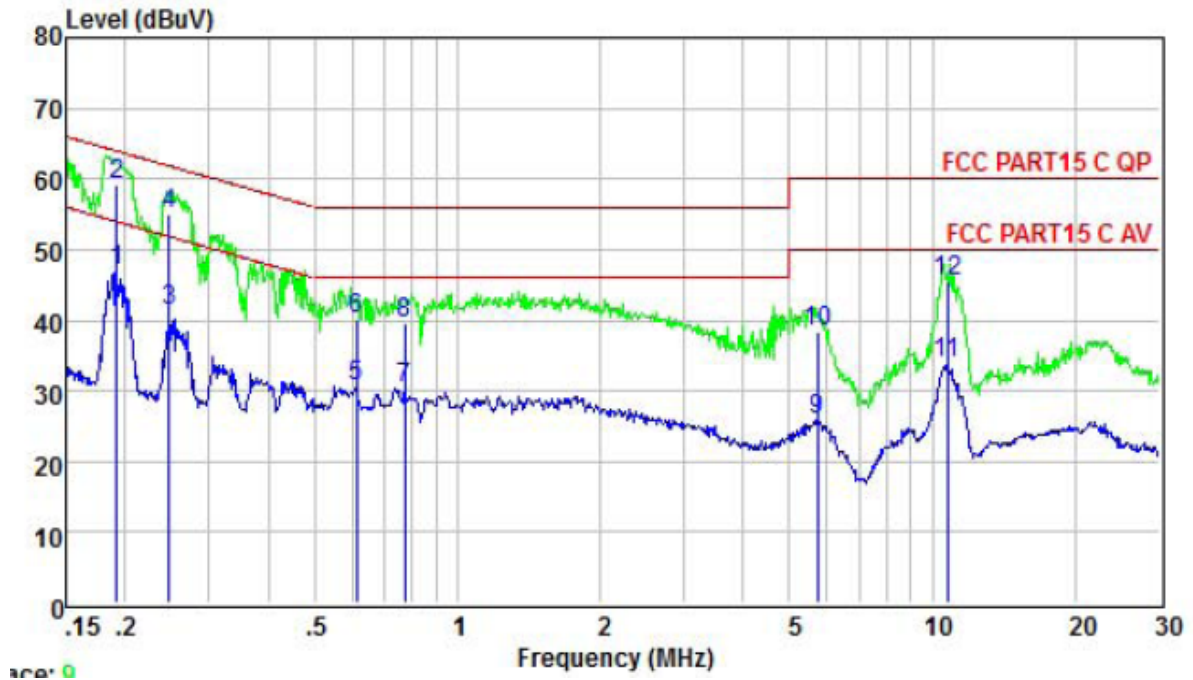
Remark:
 E.U.T: Equipment Under Test
 LISN: Line Impedance Stabilization Network
 Test table height=0.8m

Block diagram of Test Setup



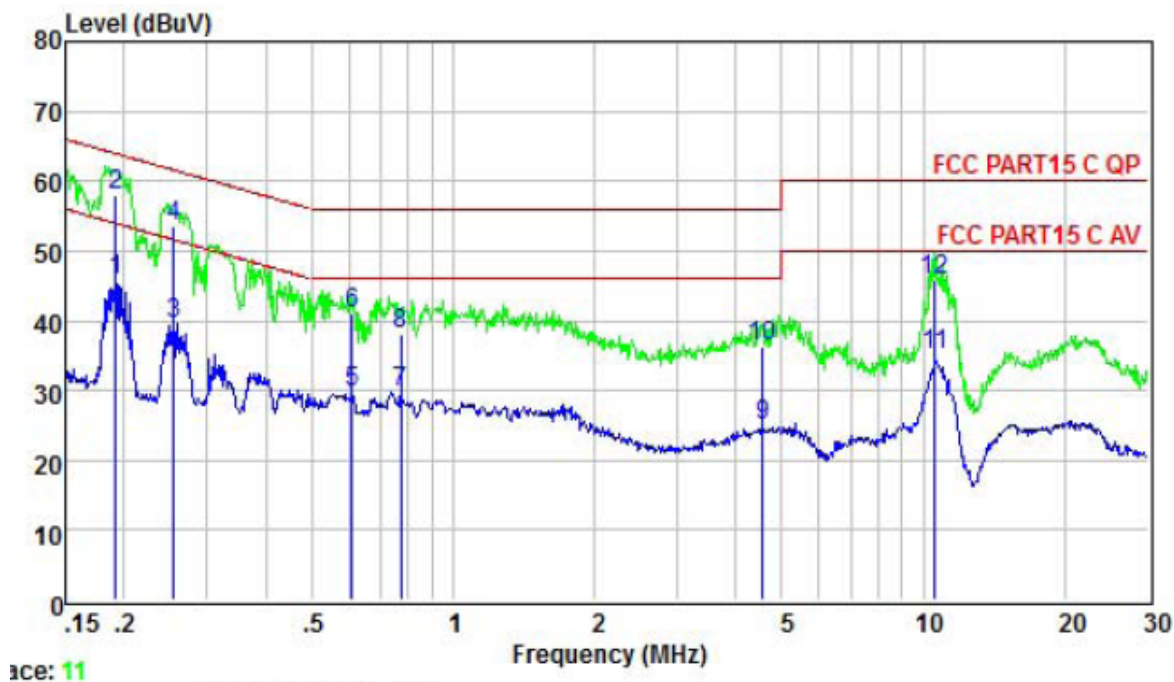
5.1.3. Test result

EUT :	Bluetooth and NFC Speaker	Model Name :	VG7
Temperature :	26 °C	Relative Humidity :	54%
Pressure :	1010hPa	Phase :	L
Test Voltage :	DC 12V from Adapter AC 120V/60Hz	Test Mode :	Mode 4



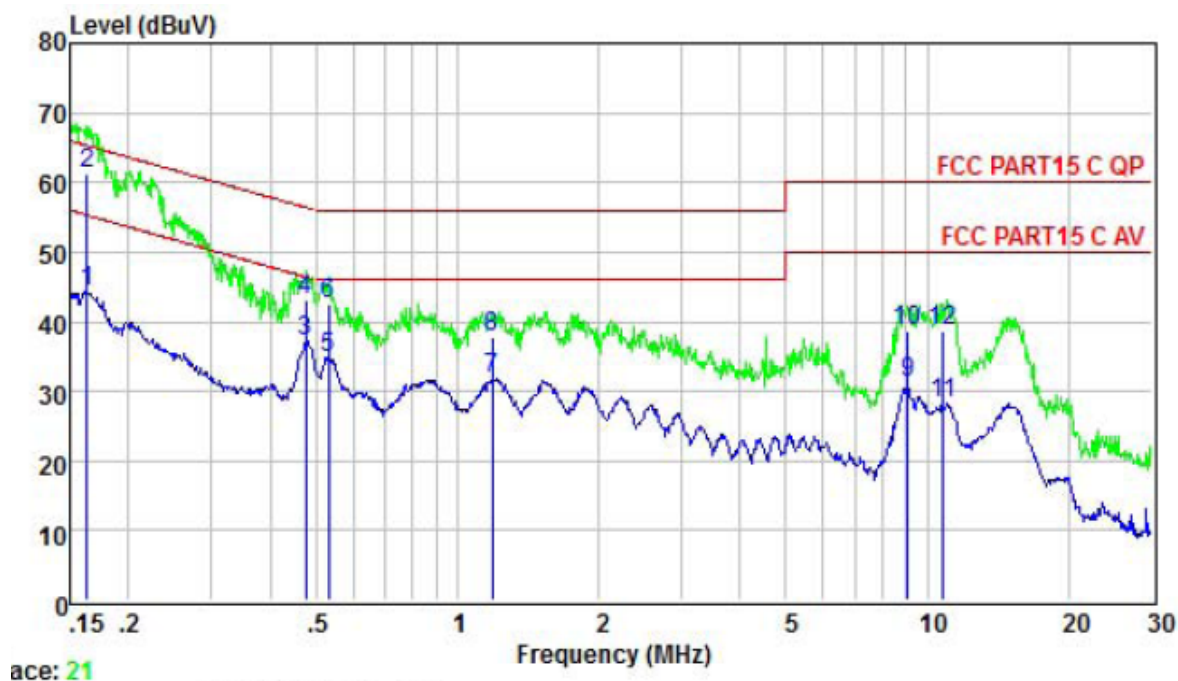
	Freq	Level	Limit	Over	Remark
	MHz	dBuV	dBuV	Limit	
				dB	
1	0.191	47.12	53.98	-6.86	Average
2	0.191	59.30	63.98	-4.68	QP
3	0.247	41.32	51.86	-10.54	Average
4	0.247	55.10	61.86	-6.76	QP
5	0.614	30.58	46.00	-15.42	Average
6	0.614	40.10	56.00	-15.90	QP
7	0.775	30.28	46.00	-15.72	Average
8	0.775	39.60	56.00	-16.40	QP
9	5.713	25.92	50.00	-24.08	Average
10	5.713	38.40	60.00	-21.60	QP
11	10.733	33.92	50.00	-16.08	Average
12	10.733	45.60	60.00	-14.40	QP

EUT :	Bluetooth and NFC Speaker	Model Name :	VG7
Temperature :	26 °C	Relative Humidity :	54%
Pressure :	1010hPa	Phase :	N
Test Voltage :	DC 12V from Adapter AC 120V/60Hz	Test Mode :	Mode 4



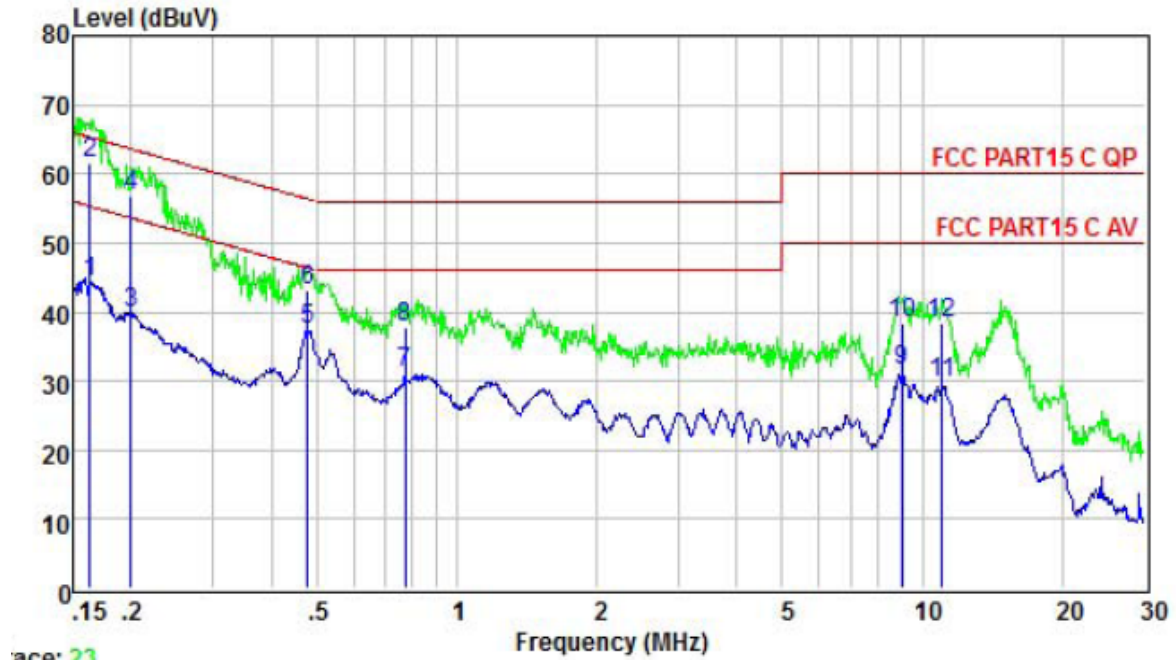
	Freq	Level	Limit	Over	Remark
	MHz	dBuV	dBuV	Limit	
1	0.191	45.68	53.98	-8.30	Average
2	0.191	58.00	63.98	-5.98	QP
3	0.255	39.47	51.60	-12.13	Average
4	0.255	53.60	61.60	-8.00	QP
5	0.611	29.80	46.00	-16.20	Average
6	0.611	41.00	56.00	-15.00	QP
7	0.775	29.65	46.00	-16.35	Average
8	0.775	38.10	56.00	-17.90	QP
9	4.549	24.90	46.00	-21.10	Average
10	4.549	36.30	56.00	-19.70	QP
11	10.564	35.00	50.00	-15.00	Average
12	10.564	45.90	60.00	-14.10	QP

EUT :	Bluetooth and NFC Speaker	Model Name :	VG7
Temperature :	26 °C	Relative Humidity :	54%
Pressure :	1010hPa	Phase :	L
Test Voltage :	DC 12V from Adapter AC 240V/60Hz	Test Mode :	Mode 4



	Freq	Level	Limit	Over	Remark
	MHz	dBuV	Line	Limit	
				dB	
1	0.163	44.39	55.30	-10.91	Average
2	0.163	61.40	65.30	-3.90	QP
3	0.476	37.17	46.41	-9.24	Average
4	0.476	43.20	56.41	-13.21	QP
5	0.532	34.90	46.00	-11.10	Average
6	0.532	42.50	56.00	-13.50	QP
7	1.184	31.85	46.00	-14.15	Average
8	1.184	37.70	56.00	-18.30	QP
9	9.059	31.10	50.00	-18.90	Average
10	9.059	38.60	60.00	-21.40	QP
11	10.790	28.34	50.00	-21.66	Average
12	10.790	38.80	60.00	-21.20	QP

EUT :	Bluetooth and NFC Speaker	Model Name :	VG7
Temperature :	26 °C	Relative Humidity :	54%
Pressure :	1010hPa	Phase :	N
Test Voltage :	DC 12V from Adapter AC 240V/60Hz	Test Mode :	Mode 4



	Freq	Level	Limit	Over	Remark
	MHz	dBuV	dBuV	Limit	dB
1	0.163	44.39	55.30	-10.91	Average
2	0.163	61.50	65.30	-3.80	QP
3	0.200	39.98	53.62	-13.64	Average
4	0.200	56.90	63.62	-6.72	QP
5	0.479	37.58	46.36	-8.78	Average
6	0.479	43.10	56.36	-13.26	QP
7	0.775	31.12	46.00	-14.88	Average
8	0.775	37.90	56.00	-18.10	QP
9	9.011	31.62	50.00	-18.38	Average
10	9.011	38.30	60.00	-21.70	QP
11	11.021	29.62	50.00	-20.38	Average
12	11.021	38.40	60.00	-21.60	QP

5.2. Radiated Emission Test

5.2.1. Limit 15.209

FREQUENCY MHz	DISTANCE Meters	FIELD STRENGTHS LIMIT	
		$\mu\text{V}/\text{m}$	$\text{dB}(\mu\text{V})/\text{m}$
30 ~ 88	3	100	40.0
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46.0
960 ~ 1000	3	500	54.0
Above 1000	3	74.0 $\text{dB}(\mu\text{V})/\text{m}$ (Peak) 54.0 $\text{dB}(\mu\text{V})/\text{m}$ (Average)	

5.2.2. Restricted bands of operation

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	(²)

All the emissions appearing within 15.205 restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

5.2.3. Test setup

The EUT was placed on a turn table which was 0.8 m above the ground blow 1G and 1.5m above 1G. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was set 3 m away from the receiving antenna which was mounted on an antenna tower. The measuring antenna moved up and down to find out the maximum emission level. It moved from 1 m to 4 m for both horizontal and vertical polarizations.

The EUT was tested in the Chamber Site. It was pre-scanned with a Peak detector from the spectrum, and all the final readings from the test receiver were measured with the Quasi-Peak detector.

The bandwidth of the EMI test receiver is set at 120kHz for frequency range from 30MHz to 1000 MHz.

The bandwidth of the Spectrum's VBW is set at 3MHz and RBW is set at 1MHz for peak emissions measurement above 1GHz and 1MHz RBW, 10Hz VBW for average emissions measure above 1GHz, the EUT was placed on a turn table which was 1.5 m above the ground, for all test, used peak detector.

The frequency range from 30MHz to 10th harmonic (25GHz) are checked. and no any emissions were found from 18GHz to 25 GHz, So the radiated emissions from 18GHz to 25GHz were not record.

Notes: 1. Emission Level = Antenna Factor + Cable Loss + Meter Reading-Preamp Factor.

2. Measurement Uncertainty: ± 3.2 dB at a level of confidence of 95%.

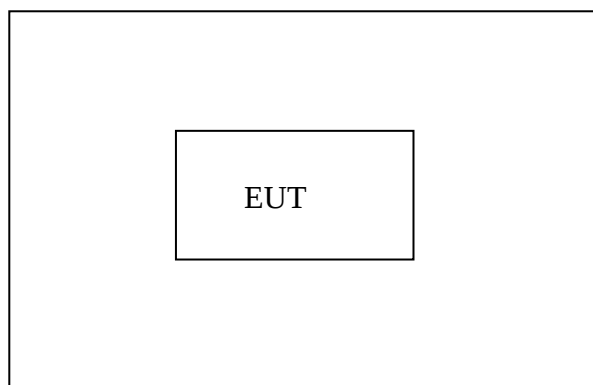
3. For emissions above 1GHz, if peak level comply with average limit, then the average level is deemed to comply with average limit.

4. For emissions below 1GHz, pretest for all mode, The test data of the worst case condition(s) was reported on the following pages.

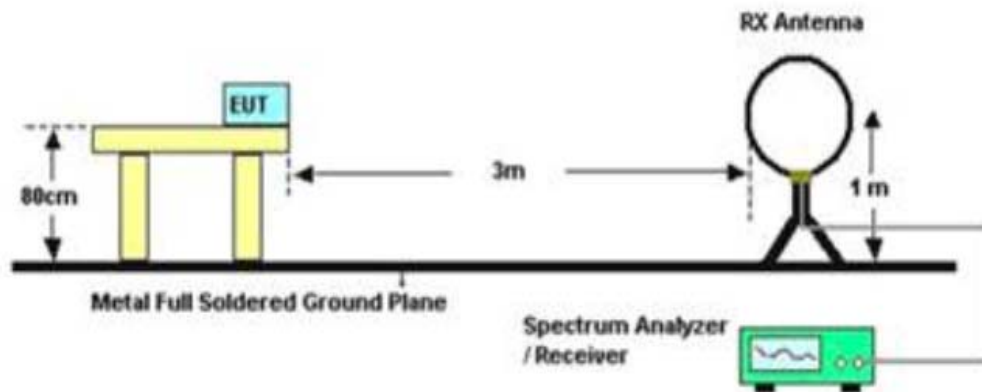
5. EUT Pre-scan X/Y/Z orientation, only worst case is presented in the report (Z orientation).

6. We pretest all modulation, The worst was GFSK, the worst data was show in the report.

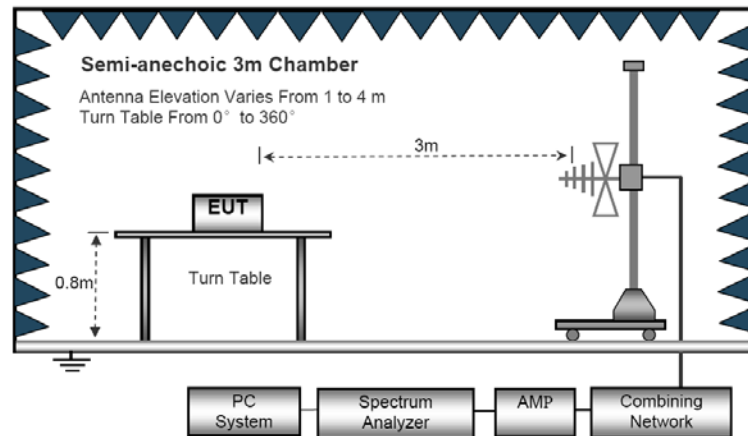
Block diagram of Test Setup



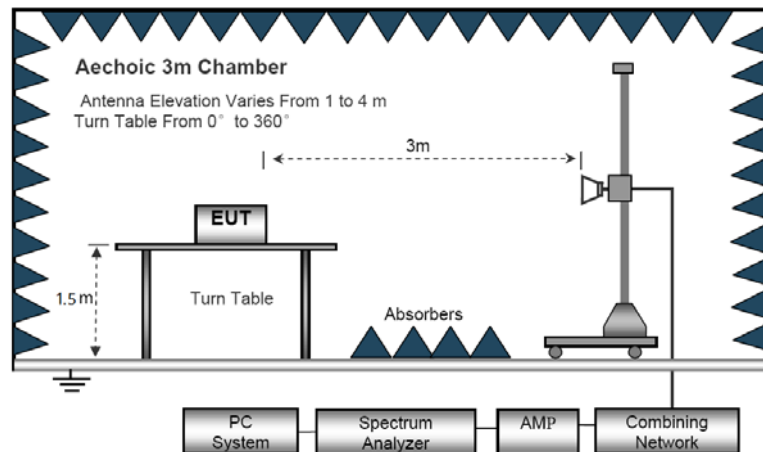
Radiated Emission Test-Up Frequency Below 30MHz



30MHz- 1GHz



Above 1GHz



EUT :	Bluetooth and NFC Speaker	Model Name :	VG7
Temperature :	24 °C	Relative Humidity :	48%
Pressure :	1010hPa	Test Mode :	TX
Test Voltage :	DC 7.4V		

Below 30MHz

Freq.	Reading	Limit	Margin	State
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	P/F
--	--	--	--	P
--	--	--	--	P

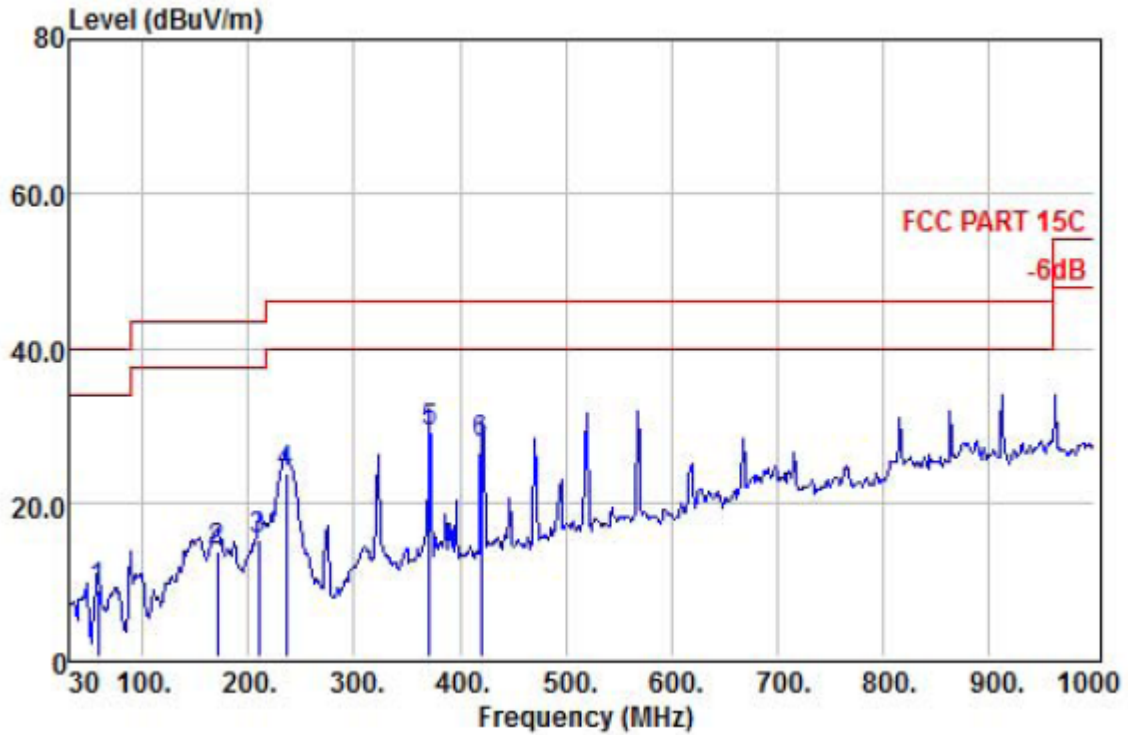
Note:

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Distance extrapolation factor = $40 \log (\text{specific distance/test distance})$ (dB);

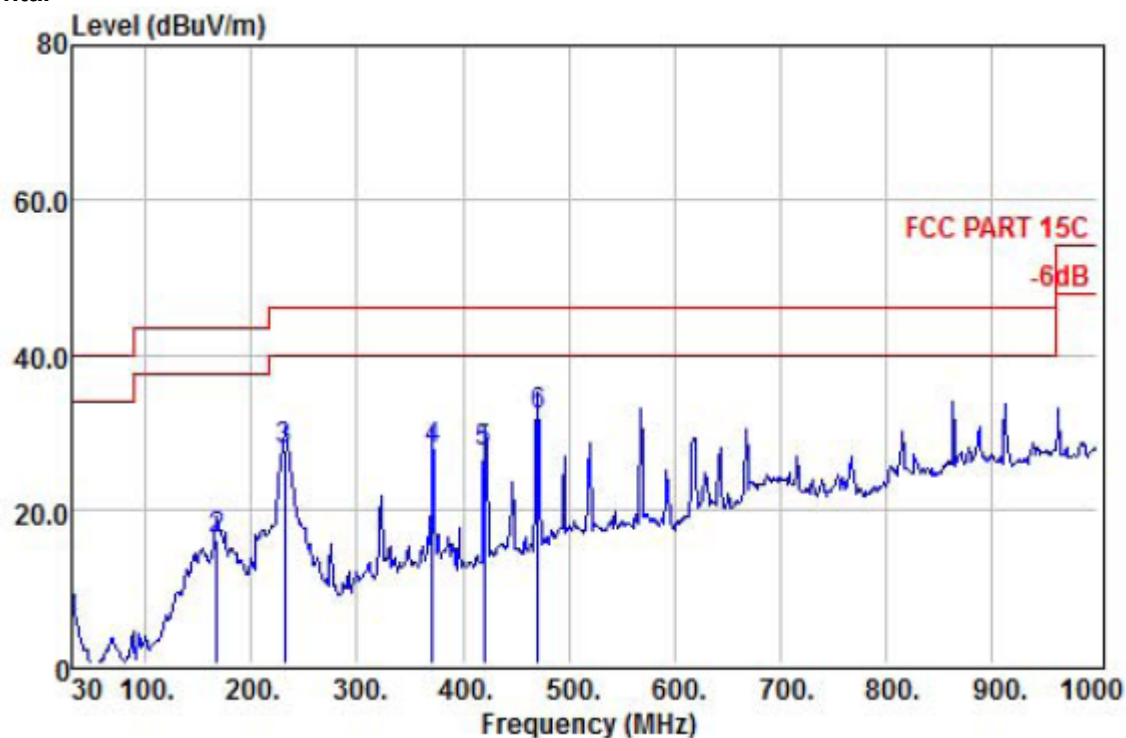
Limit line = specific limits(dBuv) + distance extrapolation factor.

EUT :	Bluetooth and NFC Speaker	Model Name :	VG7
Temperature :	24 °C	Relative Humidity :	48%
Pressure :	1010hPa	Test Mode :	TX
Test Voltage :	DC 7.4V		

30- 1GHz**Vertical**

	Freq	Read Level	Preamp Factor	Antenna Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV		dB/m	dB	dBuV/m	dBuV/m	dB	
1	57.16	31.46	31.36	7.73	0.75	8.58	40.00	-31.42	QP
2	170.65	33.35	31.19	10.12	1.30	13.58	43.50	-29.92	QP
3	209.45	33.40	31.08	11.45	1.53	15.30	43.50	-28.20	QP
4	235.64	40.62	30.94	12.50	1.61	23.79	46.00	-22.21	QP
5	371.44	41.39	30.62	16.17	2.27	29.21	46.00	-16.79	QP
6	419.94	38.97	30.63	16.94	2.48	27.76	46.00	-18.24	QP

Horizontal



	Freq	Read Level	Preamplifier Factor	Antenna Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB/m	dB	dBuV/m	dBuV/m	dB	
1	30.00	17.53	31.41	18.80	0.56	5.48	40.00	-34.52	QP
2	167.74	35.96	31.20	9.90	1.30	15.96	43.50	-27.54	QP
3	231.76	44.58	30.93	12.39	1.61	27.65	46.00	-18.35	QP
4	371.44	39.71	30.62	16.17	2.27	27.53	46.00	-18.47	QP
5	419.94	38.72	30.63	16.94	2.48	27.51	46.00	-18.49	QP
6	471.35	41.86	30.60	18.20	2.69	32.15	46.00	-13.85	QP

NOTE:

Absolute Level= ReadingLevel+antenna Factor+cable loss-preamp factor,

Over Limit= Absolute Level – Limit

1Mbps(Middle channel) is the worst mode, only worst case is presented in the report.

Above 1GHz			
EUT :	Bluetooth and NFC Speaker	Model Name :	VG7
Temperature :	24 °C	Relative Humidity :	48%
Pressure :	1010hPa	Test Mode :	1Mbps
Test Voltage :	DC 7.4V		

Frequency (MHz)	Meter Reading (dBμV)	Antenna Factor (dB)	Cable loss (dB)	Preamp factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type	Comment
TX-2402									
4804	29.08	32.94	11.96	27.49	46.49	54	-7.51	Average	Vertical
4804	39.91	32.94	11.96	27.49	57.32	74	-16.68	peak	Vertical
7206	28.49	25.28	16.61	27.94	42.44	54	-11.56	Average	Vertical
7206	39.05	25.28	16.61	27.94	53.00	74	-21.00	peak	Vertical
17100	26.35	24.76	21.42	30.14	42.39	54	-11.61	Average	Vertical
17100	40.36	24.76	21.42	30.14	56.40	74	-17.60	peak	Vertical
4804	29.15	32.94	11.96	27.49	46.56	54	-7.44	Average	Horizontal
4804	36.93	32.94	11.96	27.49	54.34	74	-19.66	peak	Horizontal
7206	28.10	25.28	16.61	27.94	42.05	54	-11.95	Average	Horizontal
7206	37.11	25.28	16.61	27.94	51.06	74	-22.94	peak	Horizontal
17100	24.78	24.76	21.42	30.14	40.82	54	-13.18	Average	Horizontal
17100	38.16	24.76	21.42	30.14	54.20	74	-19.80	peak	Horizontal
TX-2441									
4882	29.77	32.11	12.14	27.53	46.49	54	-7.51	Average	Vertical
4882	39.73	32.11	12.14	27.53	56.45	74	-17.55	peak	Vertical
7323	28.99	24.33	16.62	27.96	41.98	54	-12.02	Average	Vertical
7323	39.99	24.33	16.62	27.96	52.98	74	-21.02	peak	Vertical
17500	27.74	23.92	23.76	29.64	45.78	54	-8.22	Average	Vertical
17500	41.52	23.92	23.76	29.64	59.56	74	-14.44	peak	Vertical
4882	29.73	32.11	12.14	27.53	46.45	54	-7.55	Average	Horizontal
4882	36.72	32.11	12.14	27.53	53.44	74	-20.56	peak	Horizontal
7323	29.88	24.33	16.62	27.96	42.87	54	-11.13	Average	Horizontal
7323	38.99	24.33	16.62	27.96	51.98	74	-22.02	peak	Horizontal
17500	25.18	23.92	23.76	29.64	43.22	54	-10.78	Average	Horizontal
17500	38.93	23.92	23.76	29.64	56.97	74	-17.03	peak	Horizontal
TX-2480									
4960	29.88	31.32	12.36	27.58	45.98	54	-8.02	Average	Vertical
4960	40.77	31.32	12.36	27.58	56.87	74	-17.13	peak	Vertical
7440	28.86	24.38	16.62	27.99	41.87	54	-12.13	Average	Vertical
7440	39.86	24.38	16.62	27.99	52.87	74	-21.13	peak	Vertical
17384	26.86	23.61	22.67	29.85	43.29	54	-10.71	Average	Vertical
17384	39.12	23.61	22.67	29.85	55.55	74	-18.45	peak	Vertical
4960	30.75	31.32	12.36	27.58	46.85	54	-7.15	Average	Horizontal
4960	37.88	31.32	12.36	27.58	53.98	74	-20.02	peak	Horizontal
7440	29.66	24.38	16.62	27.99	42.67	54	-11.33	Average	Horizontal
7440	37.86	24.38	16.62	27.99	50.87	74	-23.13	peak	Horizontal
17384	25.36	23.61	22.67	29.85	41.79	54	-12.21	Average	Horizontal
17384	38.87	23.61	22.67	29.85	55.30	74	-18.70	peak	Horizontal

NOTE:1.Absolute Level= ReadingLevel+antenna Factor+cable loss-preamp factor.

2.Over Limit= Absolute Level – Limit.

3.The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has not to be reported.

4.EUT Pre-scan X/Y/Z orientation, only worst case is presented in the report (Z orientation)

Above 1GHz			
EUT :	Bluetooth and NFC Speaker	Model Name :	VG7
Temperature :	24 °C	Relative Humidity :	48%
Pressure :	1010hPa	Test Mode :	2Mbps
Test Voltage :	DC 7.4V		

Frequency	Meter Reading	Antenna Factor	Cable loss	Preamp factor	Emission Level	Limits	Margin	Detector Type	Comment
(MHz)	(dBμV)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)		
TX-2402									
4804	28.12	32.94	11.94	27.49	45.51	54	-8.49	Average	Vertical
4804	39.58	32.94	11.94	27.49	56.97	74	-17.03	peak	Vertical
7206	30.49	25.28	18.04	27.94	45.87	54	-8.13	Average	Vertical
7206	40.61	25.28	18.04	27.94	55.99	74	-18.01	peak	Vertical
17100	27.38	24.76	21.42	30.14	43.42	54	-10.58	Average	Vertical
17100	39.76	24.76	21.42	30.14	55.80	74	-18.20	peak	Vertical
4804	27.32	32.94	11.94	27.49	44.71	54	-9.29	Average	Horizontal
4804	38.61	32.94	11.94	27.49	56.00	74	-18.00	peak	Horizontal
7206	30.35	25.28	18.04	27.94	45.73	54	-8.27	Average	Horizontal
7206	42.49	25.28	18.04	27.94	57.87	74	-16.13	peak	Horizontal
17100	26.67	24.76	21.42	30.14	42.71	54	-11.29	Average	Horizontal
17100	38.58	24.76	21.42	30.14	54.62	74	-19.38	peak	Horizontal
TX-2441									
4882	28.65	32.11	12.15	27.53	45.38	54	-8.62	Average	Vertical
4882	40.18	32.11	12.15	27.53	56.91	74	-17.09	peak	Vertical
7323	30.39	24.33	18.09	27.96	44.85	54	-9.15	Average	Vertical
7323	38.76	24.33	18.09	27.96	53.22	74	-20.78	peak	Vertical
17500	27.31	23.92	23.76	29.64	45.35	54	-8.65	Average	Vertical
17500	38.86	23.92	23.76	29.64	56.90	74	-17.10	peak	Vertical
4882	27.46	32.11	12.15	27.53	44.19	54	-9.81	Average	Horizontal
4882	41.49	32.11	12.15	27.53	58.22	74	-15.78	peak	Horizontal
7323	29.38	24.33	18.09	27.96	43.84	54	-10.16	Average	Horizontal
7323	40.28	24.33	18.09	27.96	54.74	74	-19.26	peak	Horizontal
17500	26.65	23.92	23.76	29.64	44.69	54	-9.31	Average	Horizontal
17500	38.67	23.92	23.76	29.64	56.71	74	-17.29	peak	Horizontal
TX-2480									
4960	28.43	31.32	12.31	27.58	44.48	54	-9.52	Average	Vertical
4960	41.34	31.32	12.31	27.58	57.39	74	-16.61	peak	Vertical
7440	31.45	24.38	18.16	27.99	46.00	54	-8.00	Average	Vertical
7440	41.32	24.38	18.16	27.99	55.87	74	-18.13	peak	Vertical
17384	27.69	23.61	22.67	29.85	44.12	54	-9.88	Average	Vertical
17384	40.17	23.61	22.67	29.85	56.60	74	-17.40	peak	Vertical
4960	29.39	31.32	12.31	27.58	45.44	54	-8.56	Average	Horizontal
4960	41.71	31.32	12.31	27.58	57.76	74	-16.24	peak	Horizontal
7440	30.73	24.38	18.16	27.99	45.28	54	-8.72	Average	Horizontal
7440	39.85	24.38	18.16	27.99	54.40	74	-19.60	peak	Horizontal
17384	26.58	23.61	22.67	29.85	43.01	54	-10.99	Average	Horizontal
17384	39.23	23.61	22.67	29.85	55.66	74	-18.34	peak	Horizontal

NOTE: 1. Absolute Level= ReadingLevel+antenna Factor+cable loss-preamp factor.

2. Over Limit= Absolute Level – Limit.

3. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has not to be reported.

4. EUT Pre-scan X/Y/Z orientation, only worst case is presented in the report (Z orientation)

Above 1GHz			
EUT :	Bluetooth and NFC Speaker	Model Name :	VG7
Temperature :	24 °C	Relative Humidity :	48%
Pressure :	1010hPa	Test Mode :	3Mbps
Test Voltage :	DC 7.4V		

Frequency	Meter Reading	Antenna Factor	Cable loss	Preamp factor	Emission Level	Limits	Margin	Detector Type	Comment
(MHz)	(dBμV)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)		
TX-2402									
4804	28.16	32.94	11.94	27.49	45.55	54	-8.45	Average	Vertical
4804	37.28	32.94	11.94	27.49	54.67	74	-19.33	peak	Vertical
7206	30.26	25.28	18.04	27.94	45.64	54	-8.36	Average	Vertical
7206	42.35	25.28	18.04	27.94	57.73	74	-16.27	peak	Vertical
17100	28.73	24.76	21.42	30.14	44.77	54	-9.23	Average	Vertical
17100	40.52	24.76	21.42	30.14	56.56	74	-17.44	peak	Vertical
4804	28.17	32.94	11.94	27.49	45.56	54	-8.44	Average	Horizontal
4804	41.73	32.94	11.94	27.49	59.12	74	-14.88	peak	Horizontal
7206	29.67	25.28	18.04	27.94	45.05	54	-8.95	Average	Horizontal
7206	40.29	25.28	18.04	27.94	55.67	74	-18.33	peak	Horizontal
17100	27.58	24.76	21.42	30.14	43.62	54	-10.38	Average	Horizontal
17100	39.13	24.76	21.42	30.14	55.17	74	-18.83	peak	Horizontal
TX-2441									
4882	28.48	32.11	12.15	27.53	45.21	54	-8.79	Average	Vertical
4882	40.15	32.11	12.15	27.53	56.88	74	-17.12	peak	Vertical
7323	31.12	24.33	18.09	27.96	45.58	54	-8.42	Average	Vertical
7323	41.25	24.33	18.09	27.96	55.71	74	-18.29	peak	Vertical
17500	26.28	23.92	23.76	29.64	44.32	54	-9.68	Average	Vertical
17500	40.21	23.92	23.76	29.64	58.25	74	-15.75	peak	Vertical
4882	28.38	32.11	12.15	27.53	45.11	54	-8.89	Average	Horizontal
4882	40.62	32.11	12.15	27.53	57.35	74	-16.65	peak	Horizontal
7323	30.23	24.33	18.09	27.96	44.69	54	-9.31	Average	Horizontal
7323	39.55	24.33	18.09	27.96	54.01	74	-19.99	peak	Horizontal
17500	27.29	23.92	23.76	29.64	45.33	54	-8.67	Average	Horizontal
17500	40.62	23.92	23.76	29.64	58.66	74	-15.34	peak	Horizontal
TX-2480									
4960	29.15	31.32	12.36	27.58	45.25	54	-8.75	Average	Vertical
4960	40.45	31.32	12.36	27.58	56.55	74	-17.45	peak	Vertical
7440	28.80	24.38	16.62	27.99	41.81	54	-12.19	Average	Vertical
7440	39.73	24.38	16.62	27.99	52.74	74	-21.26	peak	Vertical
17384	28.67	23.61	22.67	29.85	45.10	54	-8.90	Average	Vertical
17384	40.53	23.61	22.67	29.85	56.96	74	-17.04	peak	Vertical
4960	28.70	31.32	12.36	27.58	44.80	54	-9.20	Average	Horizontal
4960	39.88	31.32	12.36	27.58	55.98	74	-18.02	peak	Horizontal
7440	29.46	24.38	16.62	27.99	42.47	54	-11.53	Average	Horizontal
7440	37.59	24.38	16.62	27.99	50.60	74	-23.40	peak	Horizontal
17384	27.55	23.61	22.67	29.85	43.98	54	-10.02	Average	Horizontal
17384	40.56	23.61	22.67	29.85	56.99	74	-17.01	peak	Horizontal

NOTE: 1. Absolute Level= Reading Level+antenna Factor+cable loss-preamp factor.

2. Over Limit= Absolute Level – Limit.

3. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has not to be reported.

4. EUT Pre-scan X/Y/Z orientation, only worst case is presented in the report (Z orientation)

6. 20DB OCCUPY BANDWIDTH

6.1. Limits

According to FCC Section 15.247(a)(1)

The 20dB bandwidth is known as the 99% emission bandwidth, or 20dB bandwidth($10 \cdot \log 1\% = 20\text{dB}$) taking the RF output power

6.2. Test setup

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum, During the measurement, the Bluetooth module of the EUT is activated and controlled by the software, and is set to operate under test mode transmitting.

2. Set the spectrum analyzer:

Span: approximately 2 to 3 times the 20dB bandwidth, centered on a hopping channel

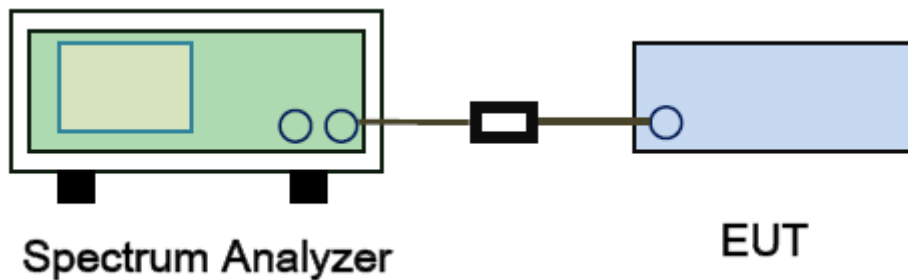
RBW $\geq 1\%$ of the 20dB bandwidth

VBW $\geq$ RBW

Sweep=auto

Detector function=peak

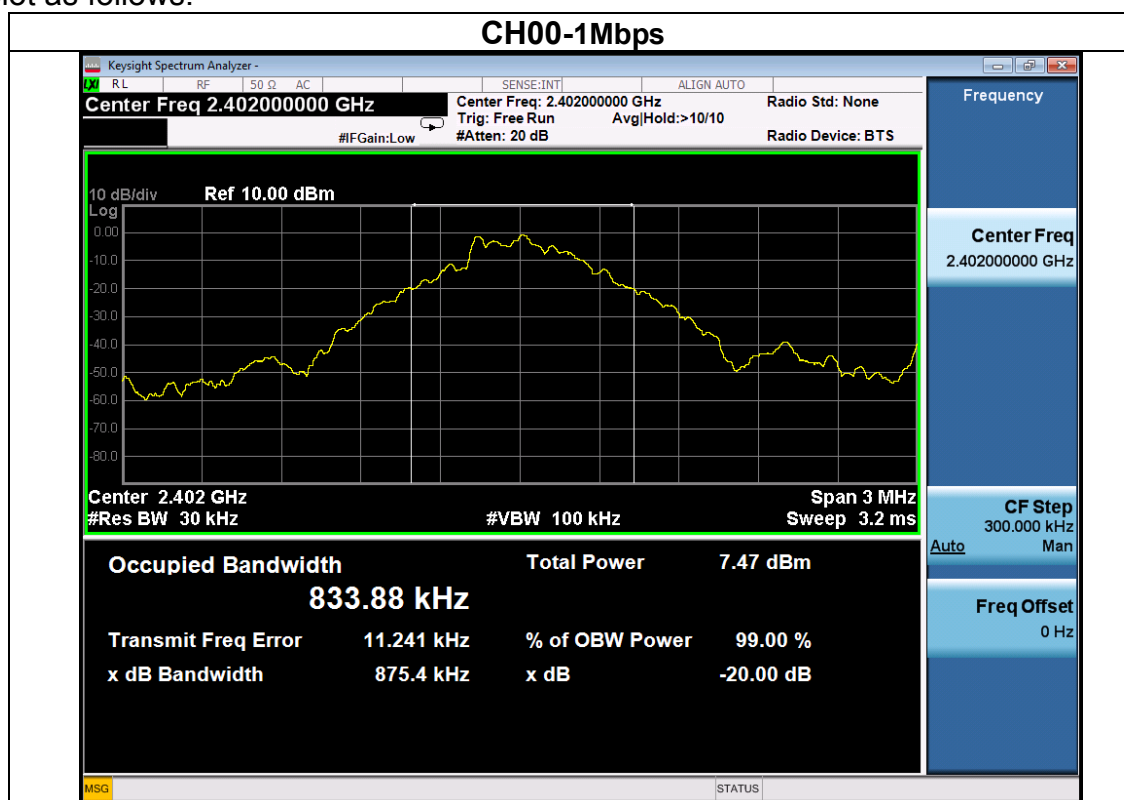
Trace=max hold



EUT :	Bluetooth and NFC Speaker	Model Name :	VG7
Temperature :	25 °C	Relative Humidity :	60%
Pressure :	1012 hPa	Test Voltage :	DC 7.4V
Test Mode :	CH00 / CH39 /C78(1Mbps)		

Frequency	20dB Bandwidth (kHz)	Result
2402 MHz	875.400	PASS
2441 MHz	875.800	PASS
2480 MHz	861.300	PASS

Test plot as follows:



CH39 -1Mbps



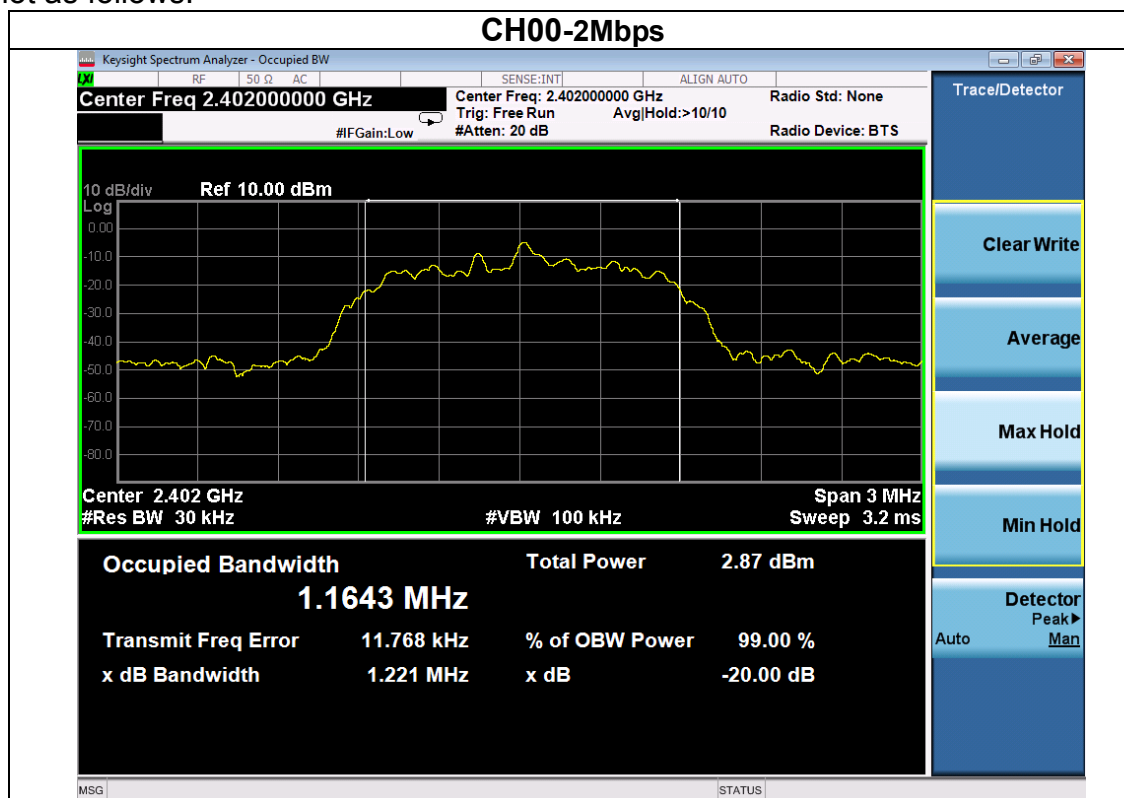
CH78 -1Mbps



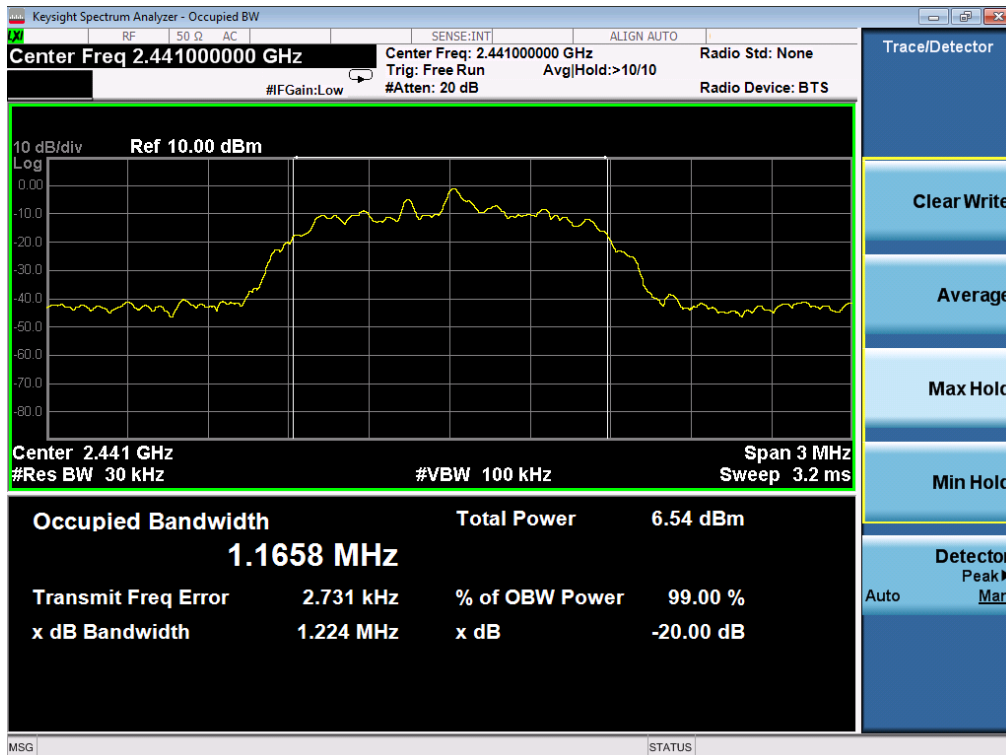
EUT :	Bluetooth and NFC Speaker	Model Name :	VG7
Temperature :	25 °C	Relative Humidity :	60%
Pressure :	1012 hPa	Test Voltage :	DC 7.4V
Test Mode :	CH00 / CH39 /C78(2Mbps)		

Frequency	20dB Bandwidth (MHz)	Result
2402 MHz	1.221	PASS
2441 MHz	1.224	PASS
2480 MHz	1.222	PASS

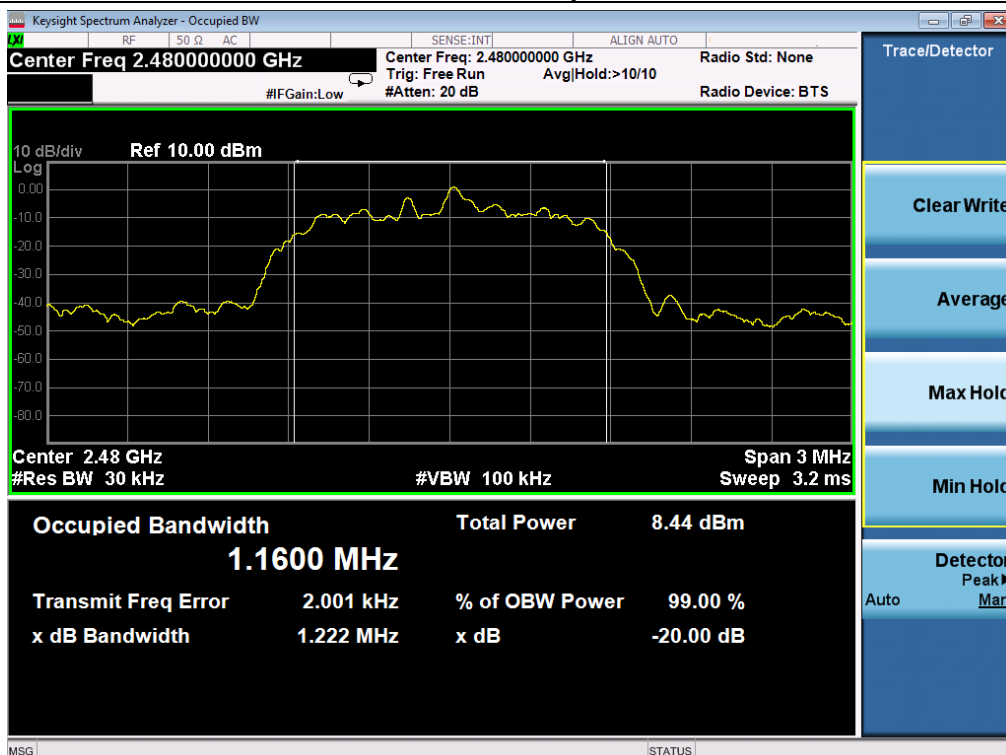
Test plot as follows:



CH39 -2Mbps

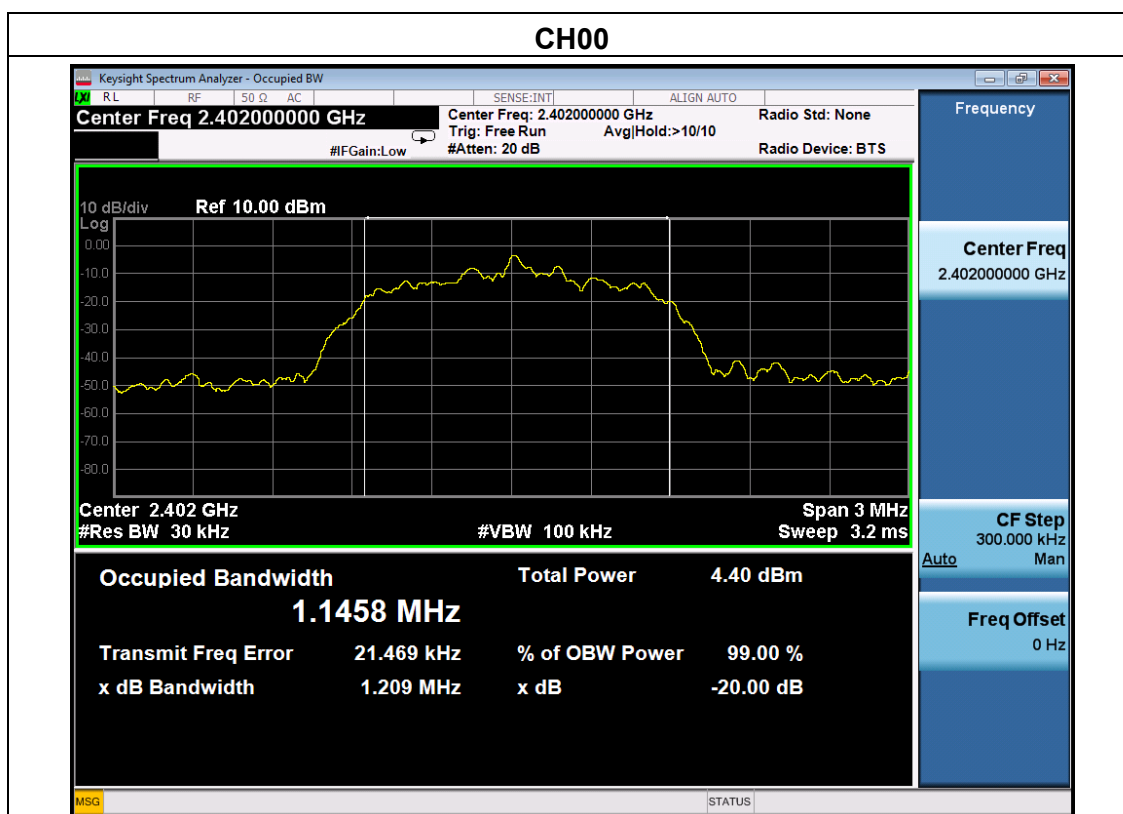


CH78 -2Mbps

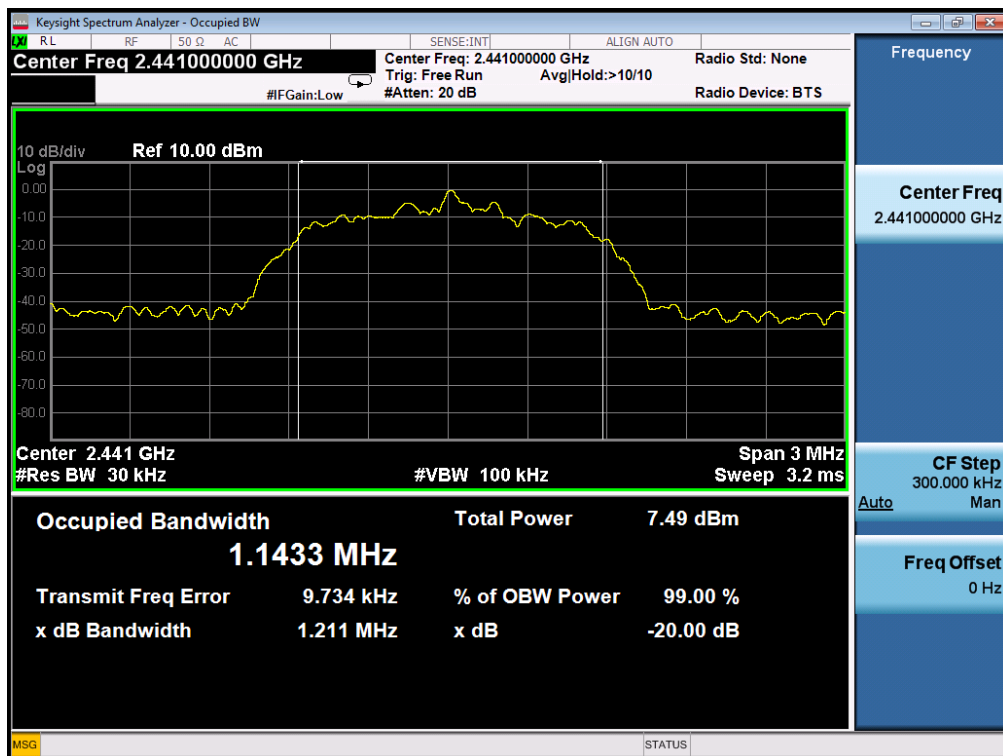


EUT :	Bluetooth and NFC Speaker	Model Name :	VG7
Temperature :	25 °C	Relative Humidity :	60%
Pressure :	1012 hPa	Test Voltage :	DC 7.4V
Test Mode :	CH00 / CH39 /CH78(3Mbps)		

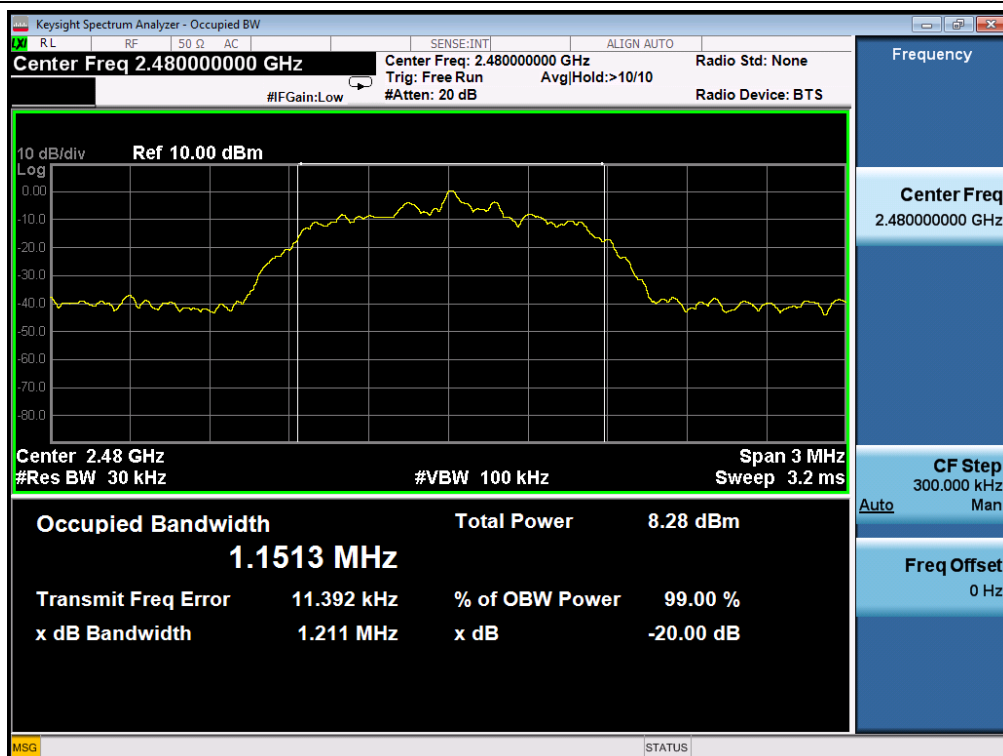
Frequency	20dB Bandwidth (MHz)	Result
2402 MHz	1.209	PASS
2441 MHz	1.211	PASS
2480 MHz	1.211	PASS



CH39



CH78



7. FREQUENCY SEPARATION

7.1. Limits

According to FCC Section 15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.

7.2. Test setup

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum, During the measurement, the Bluetooth module of the EUT is activated and controlled by the software, and is set to operate under test mode .

2. Set the spectrum analyzer:

Span: wide enough to capture the peaks of two adjacent channels

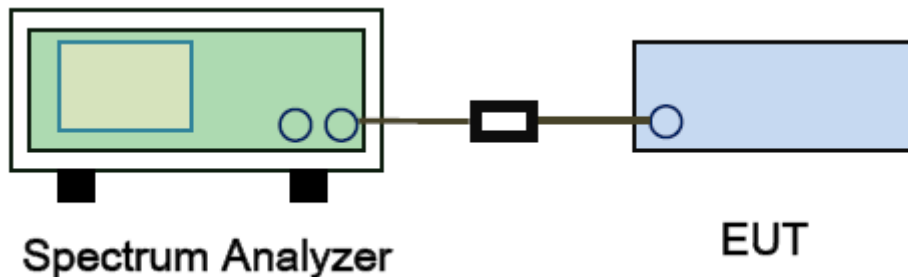
RBW $\geq 1\%$ of the span(30KHz)

VBW $\geq$ RBW(100KHz)

Sweep=auto

Detector function=peak

Trace=max hold



Test data:

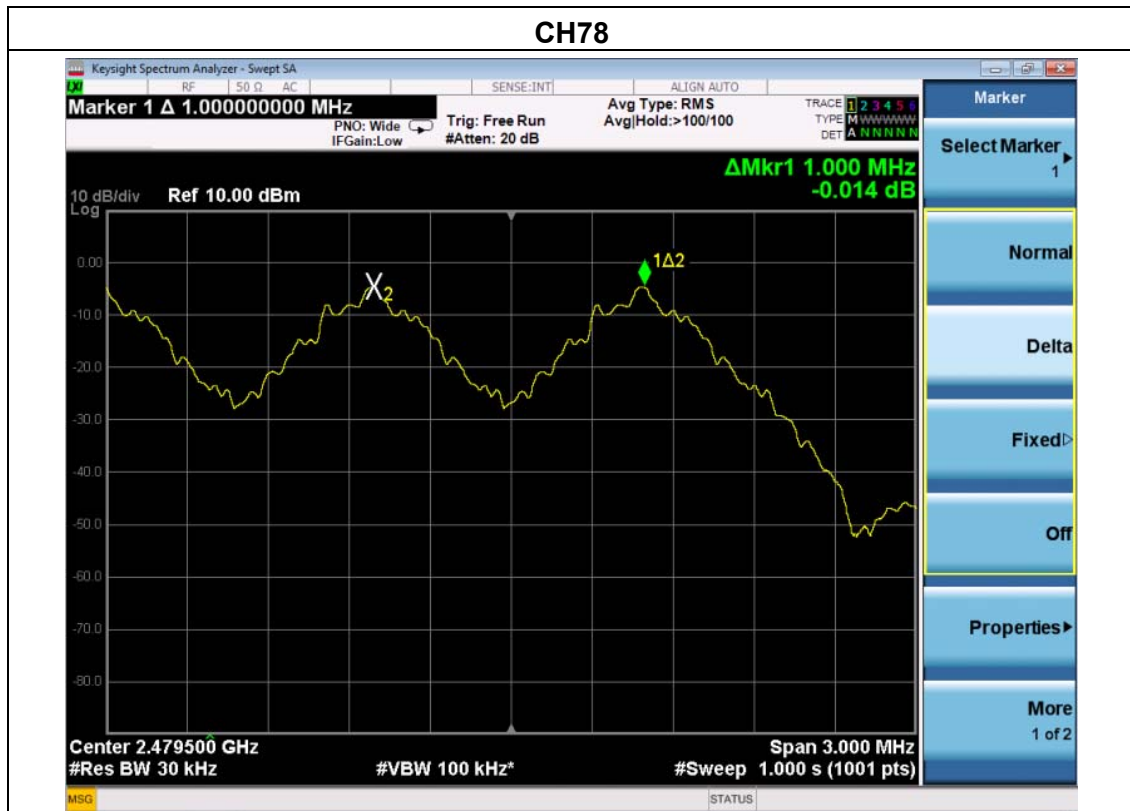
EUT :	Bluetooth and NFC Speaker	Model Name :	VG7
Temperature :	24 °C	Relative Humidity :	58%
Pressure :	1010hPa	Test Voltage :	DC 7.4V
Test Mode :	CH00 /CH78(1Mbps)		

Frequency	Ch. Separation (MHz)	Result
2402 MHz	1.000	Complies
2480 MHz	1.000	Complies

Ch. Separation Limits: > 20dB bandwidth

Test plot as follows:



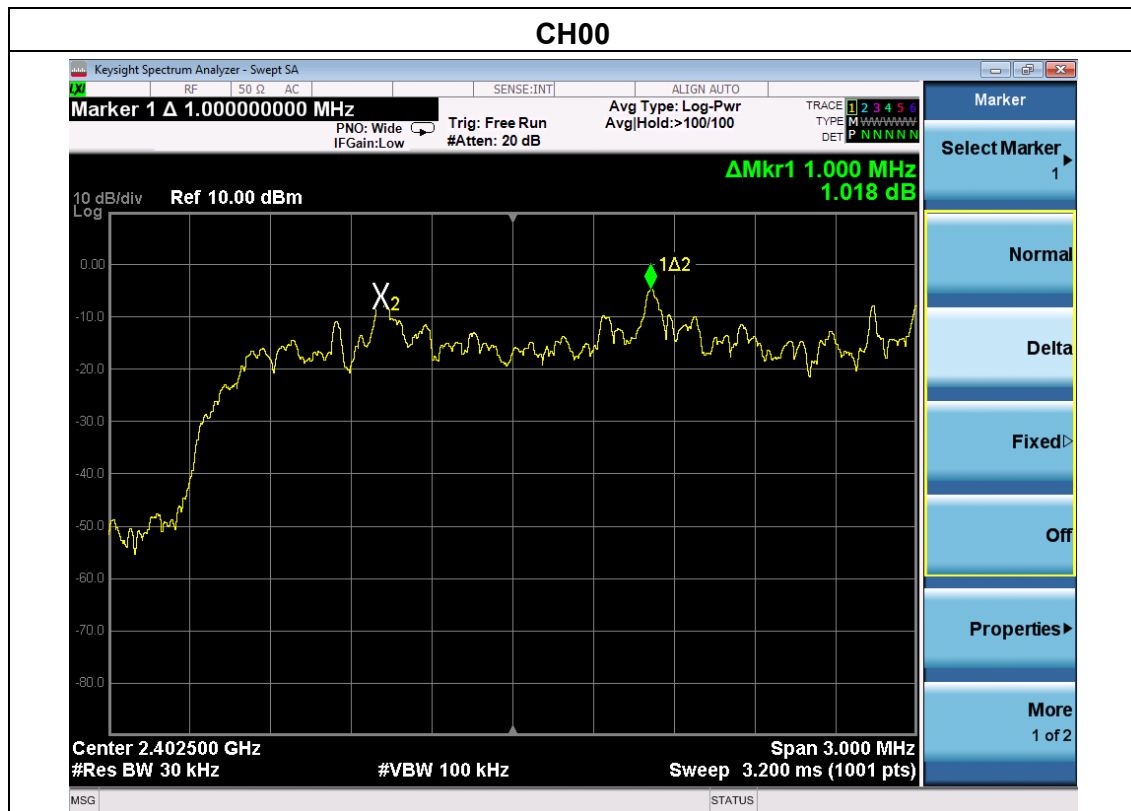


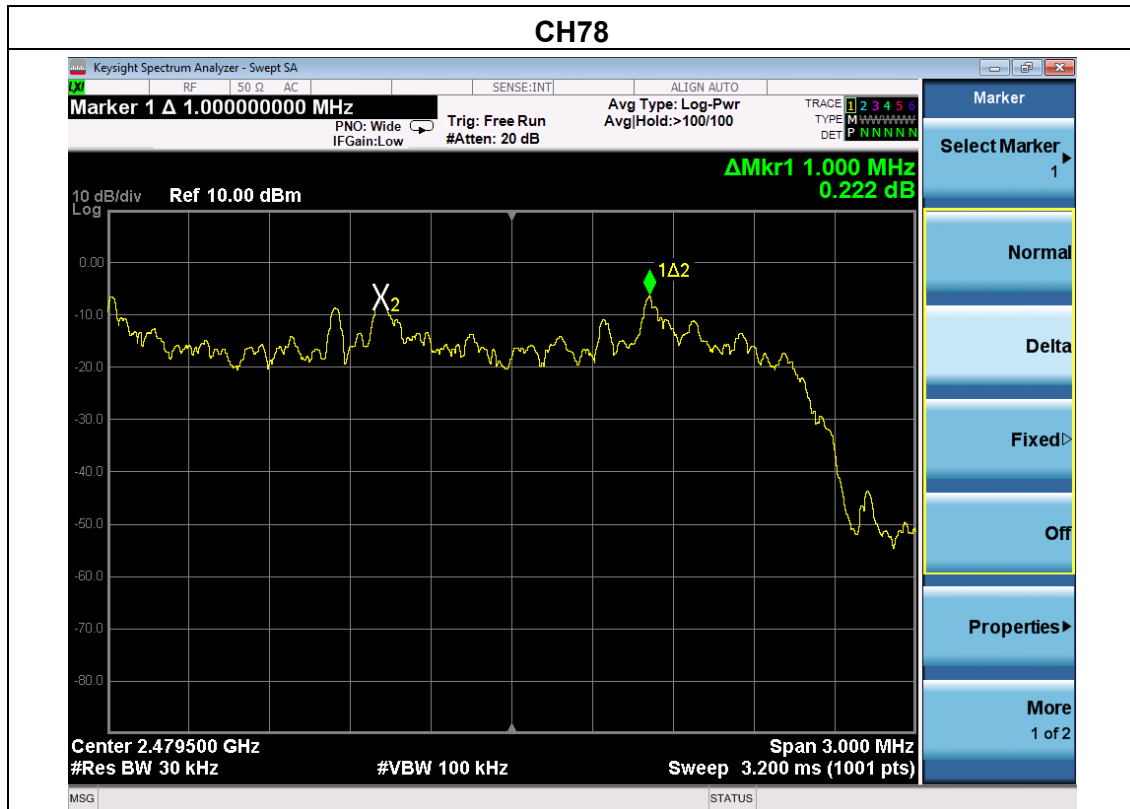
EUT :	Bluetooth and NFC Speaker	Model Name :	VG7
Temperature :	24 °C	Relative Humidity :	58%
Pressure :	1010hPa	Test Voltage :	DC 7.4V
Test Mode :	CH00 /CH78(2Mbps)		

Frequency	Ch. Separation (MHz)	Result
2402 MHz	1.000	Complies
2480 MHz	1.000	Complies

Ch. Separation Limits: > 20dB bandwidth

Test plot as follows:

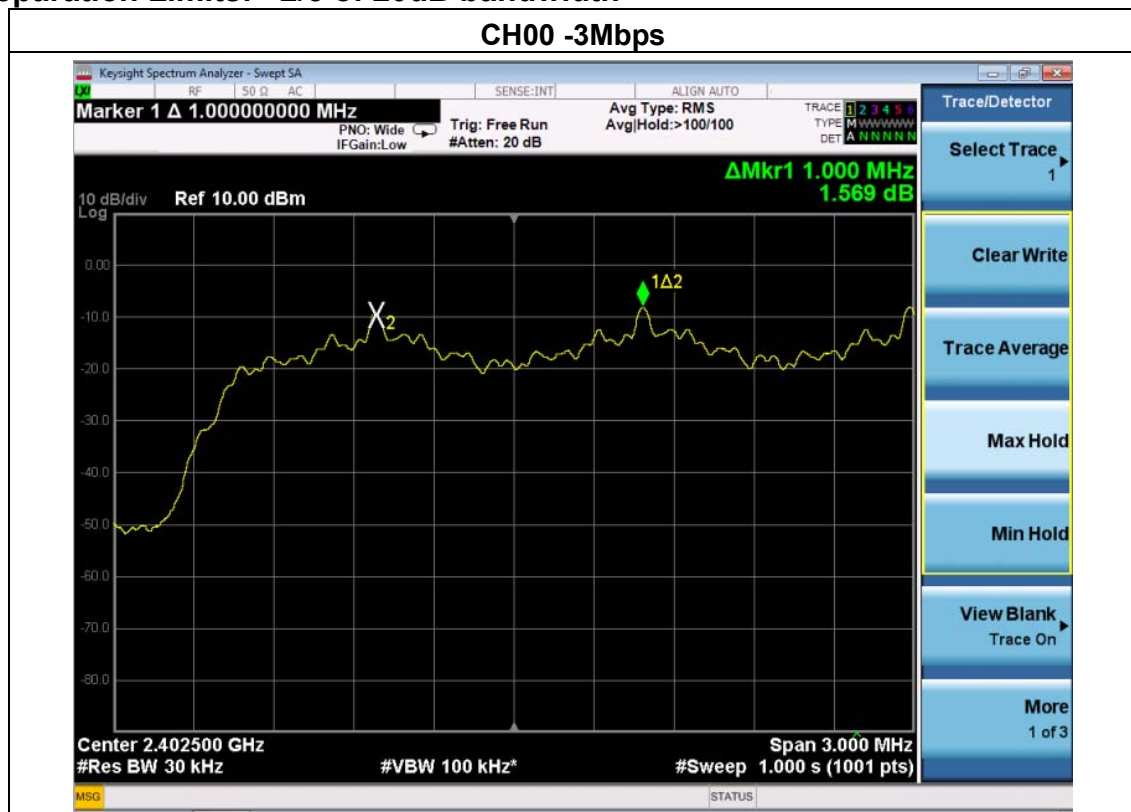


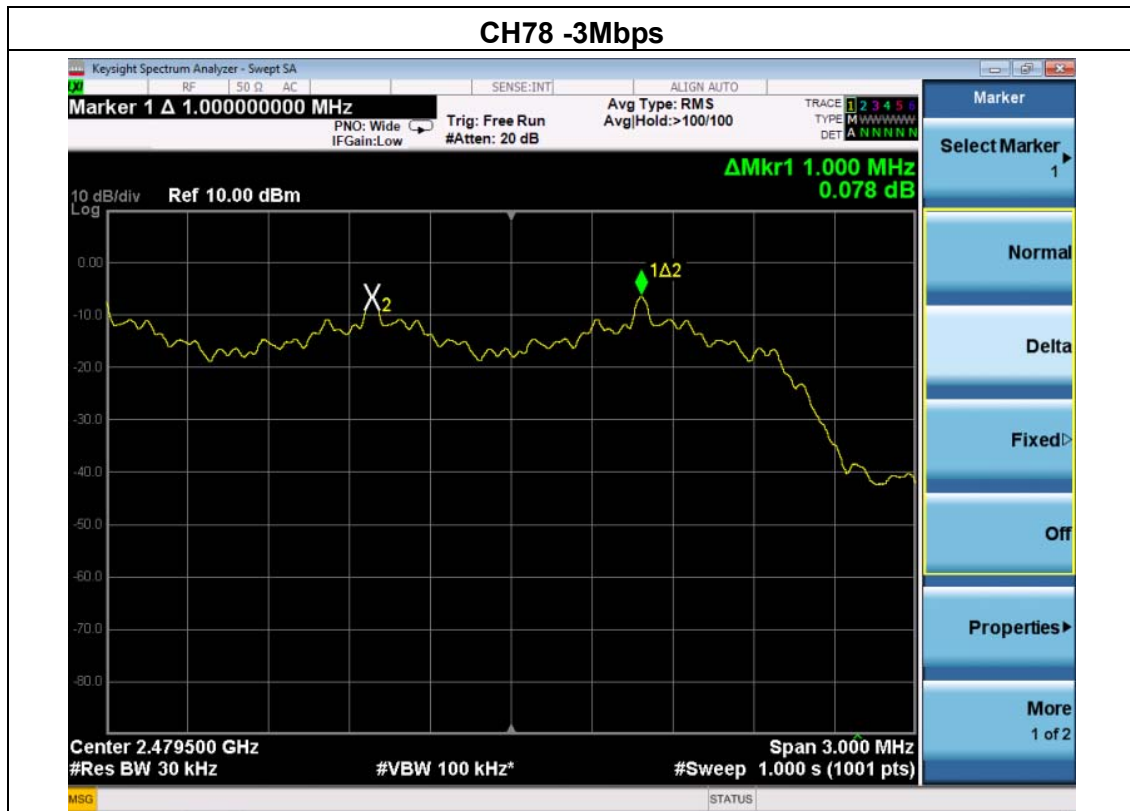


EUT :	Bluetooth and NFC Speaker	Model Name :	VG7
Temperature :	24 °C	Relative Humidity :	58%
Pressure :	1010 hPa	Test Voltage :	DC 7.4V
Test Mode :	CH00 /CH78(3Mbps)		

Frequency	Ch. Separation (MHz)	Result
2402 MHz	1.000	Complies
2480 MHz	1.000	Complies

Ch. Separation Limits: >2/3 of 20dB bandwidth





8. NUMBER OF HOPPING FREQUENCY

8.1. Limits

According to FCC Section 15.247(a)(1)(iii), Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels.

8.2. Test setup

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum, During the measurement, the Bluetooth module of the EUT is activated and controlled by the software, and is set to operate under test mode .

2. Set the spectrum analyzer:

Span: the frequency band of operation

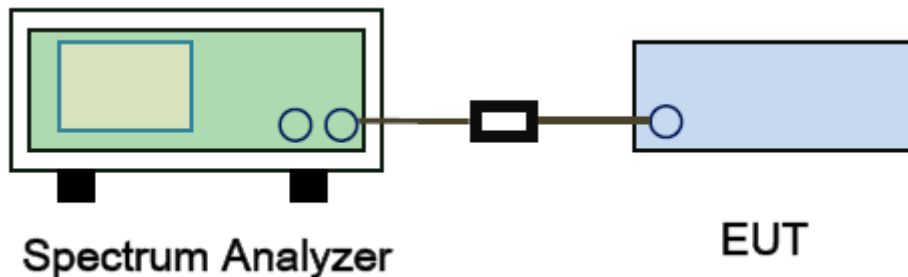
RBW =100KHz

VBW=300KHz

Sweep=auto

Detector function=peak

Trace=max hold

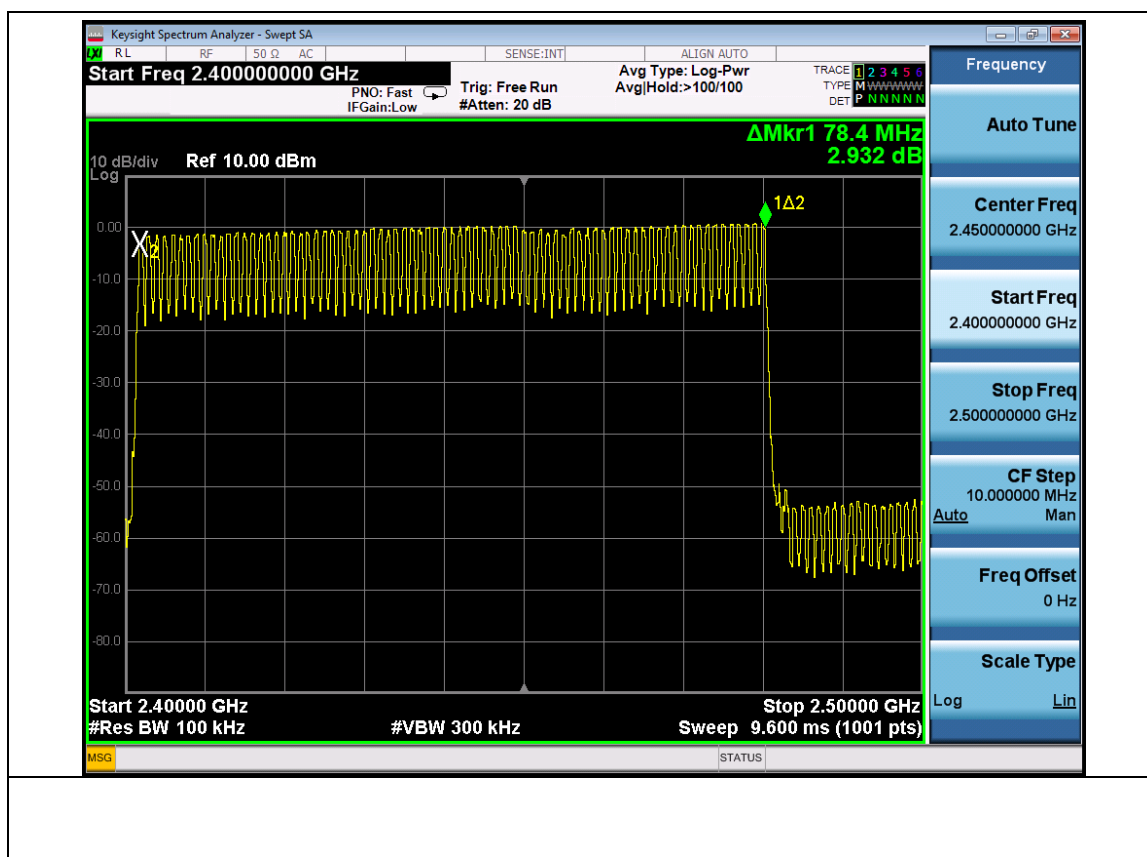


EUT :	Bluetooth and NFC Speaker	Model Name :	VG7
Temperature :	24 °C	Relative Humidity :	58%
Pressure :	1010 hPa	Test Voltage :	DC 7.4V
Test Mode :	1Mbps		

Test data:

Measured channel numbers	Limit	Result
79	≥ 15	PASS

Test plot as follows:



9. DWELL TIME

9.1. Limits

According to FCC Section 15.247(a)(1)(iii), Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

9.2. Test setup

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum, During the measurement, the Bluetooth module of the EUT is activated and controlled by the software, and is set to operate under test mode power.

2. Set the spectrum analyzer:

Span= 0Hz, RBW =1000 kHz, VBW = 3000 kHz

Use a video trigger with the trigger level set to enable triggering only on full pulses.

Detector function=peak, Sweep Time is more than once pulse time.

Set the EUT for DH5, DH3 and DH1 packet transmitting

Measure the maximum time duration of one single pulse.

A Period Time = (channel number)*0.4

DH1 Time Slot: Reading * (1600/2)*31.6/(channel number)

DH3 Time Slot: Reading * (1600/4)*31.6/(channel number)

DH5 Time Slot: Reading * (1600/6)*31.6/(channel number)

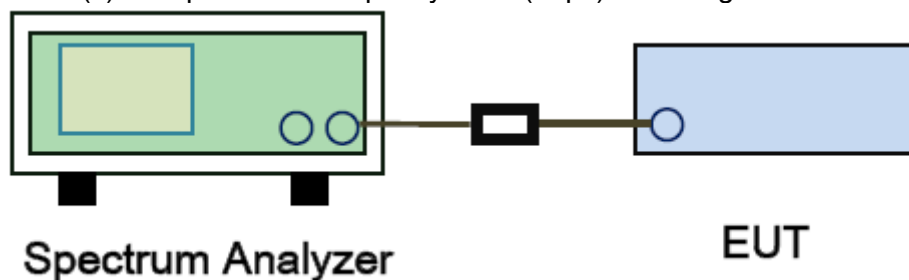
For Example:

BT hopping rate is 1600 hops/s with 6 slots in 79 hopping channels.

With channel hopping rate (1600 / 6 / 79) in Occupancy Time Limit (0.4 x 79) (s),

Hops Over Occupancy Time comes to (1600 / 6 / 79) x (0.4 x 79) = 106.67 hops.

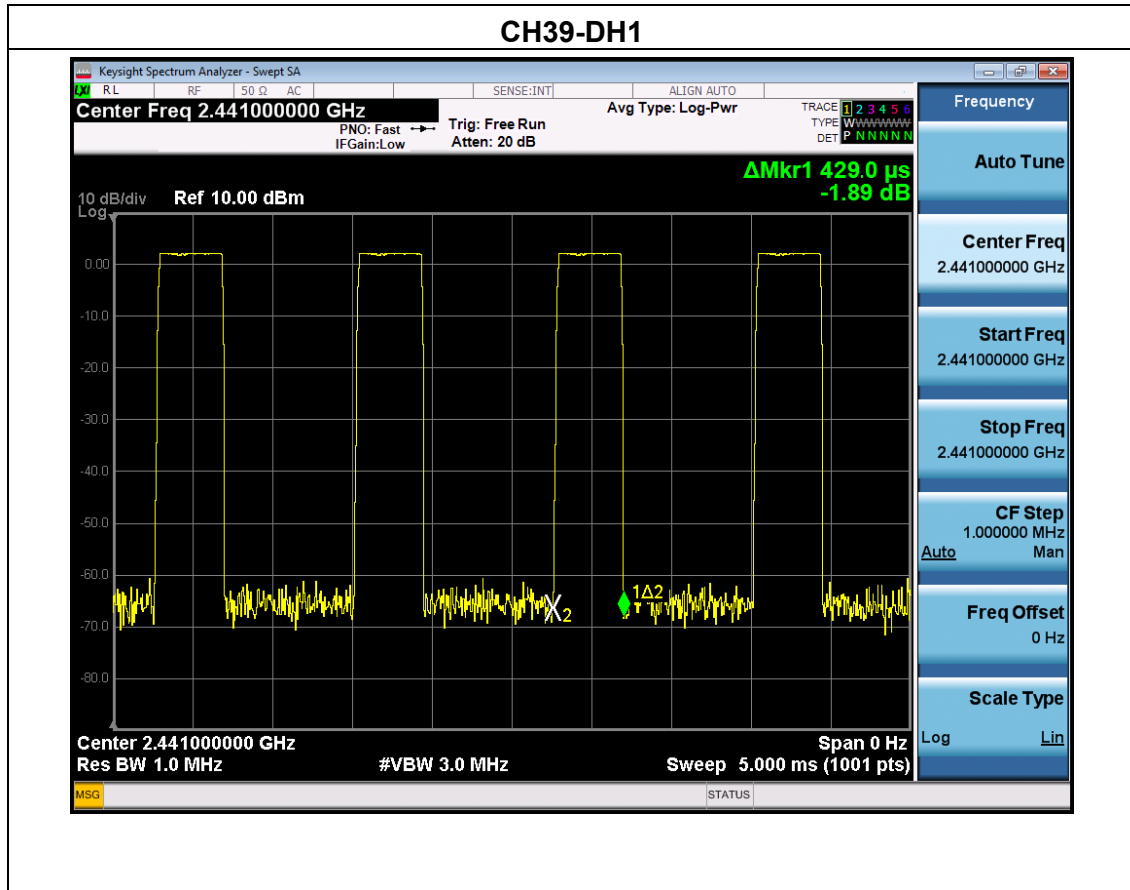
Dwell Time(s) = Hops Over Occupancy Time (hops) x Package Transfer Time



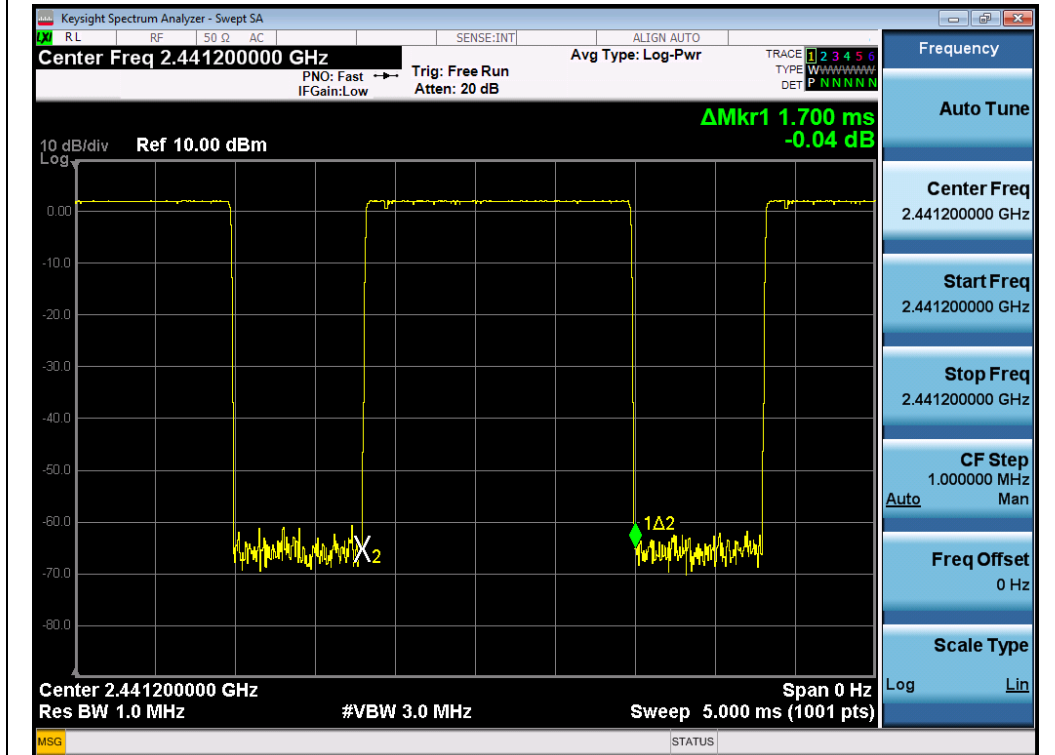
Test data:

Data Packet	Frequency	Pulse Duration	Dwell Time	Limits
		(ms)	(s)	(s)
DH1	2441 MHz	0.43	0.14	0.4
DH3	2441 MHz	1.70	0.27	0.4
DH5	2441 MHz	2.94	0.31	0.4

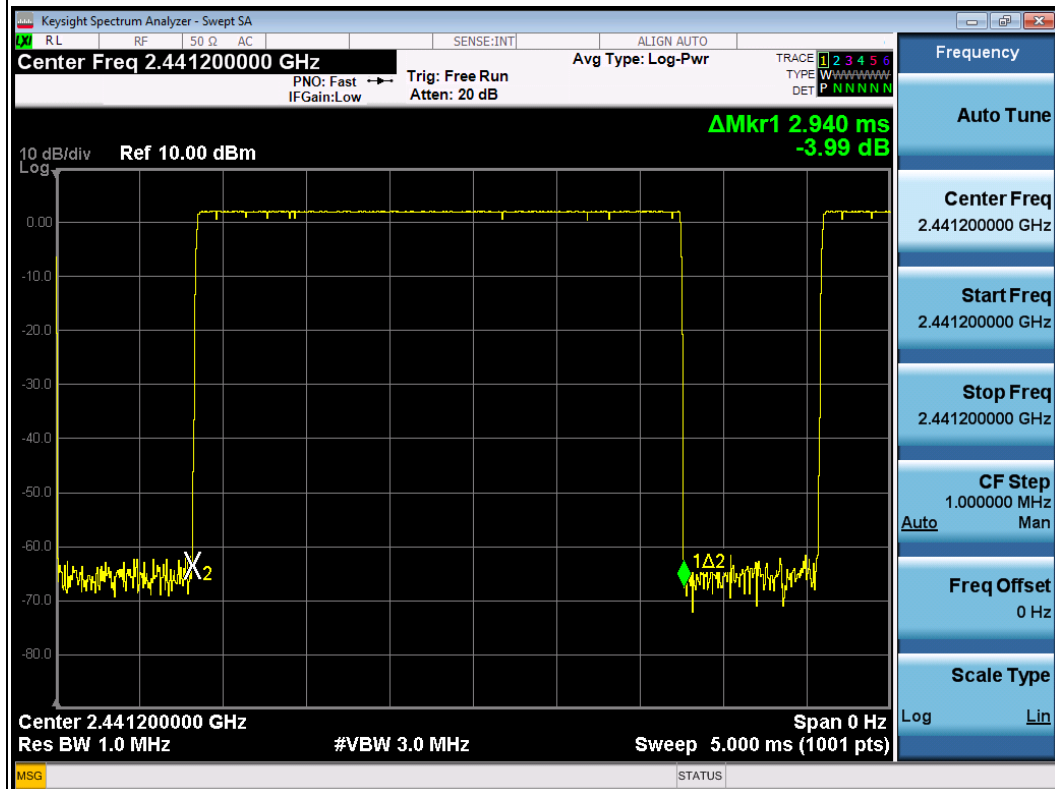
Test plot as follows as below:



CH39-DH3

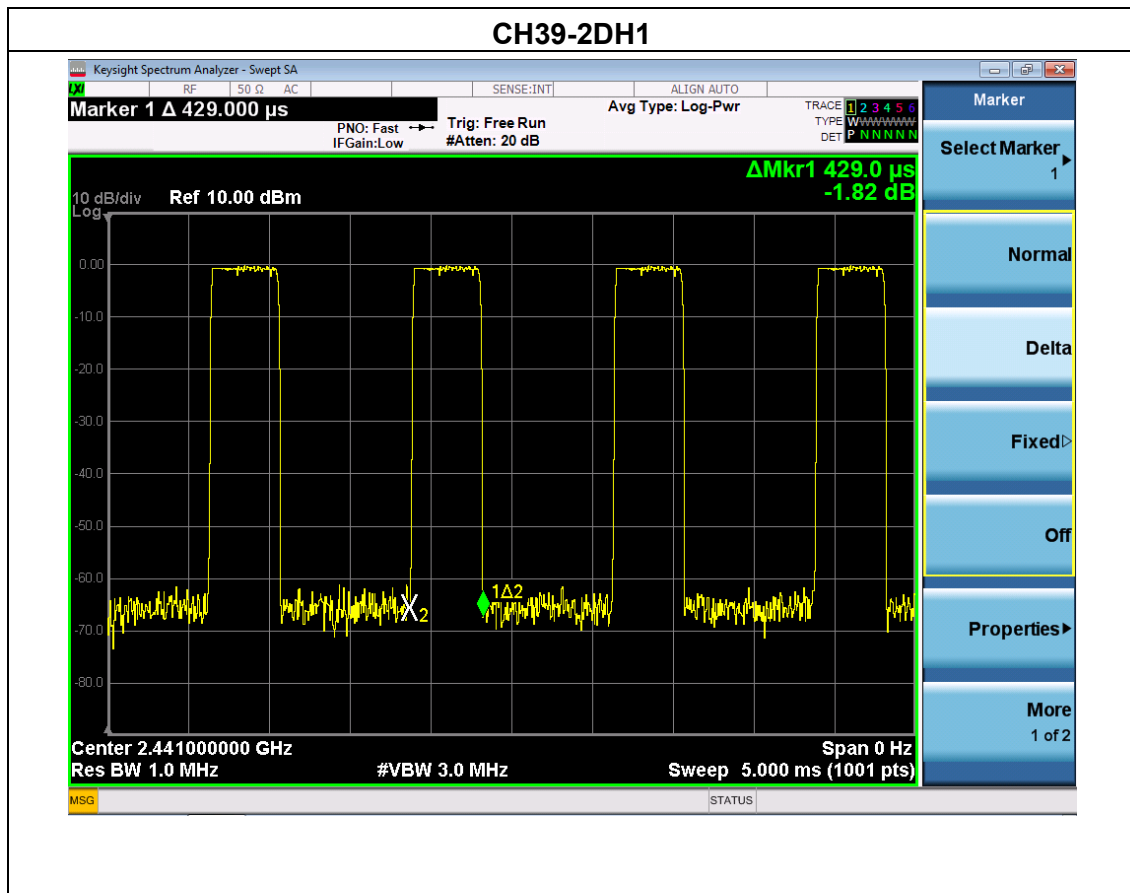


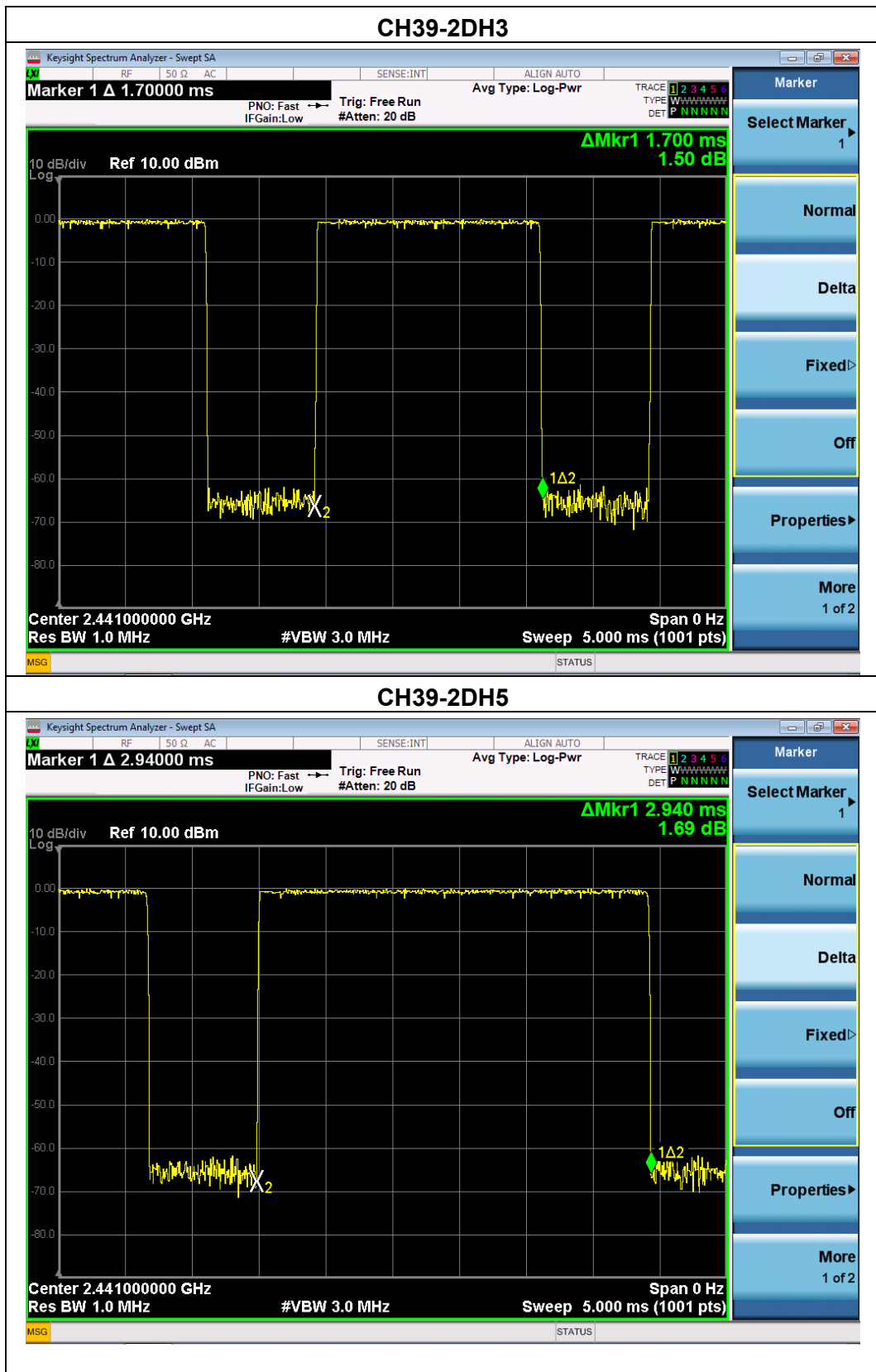
CH39-DH5



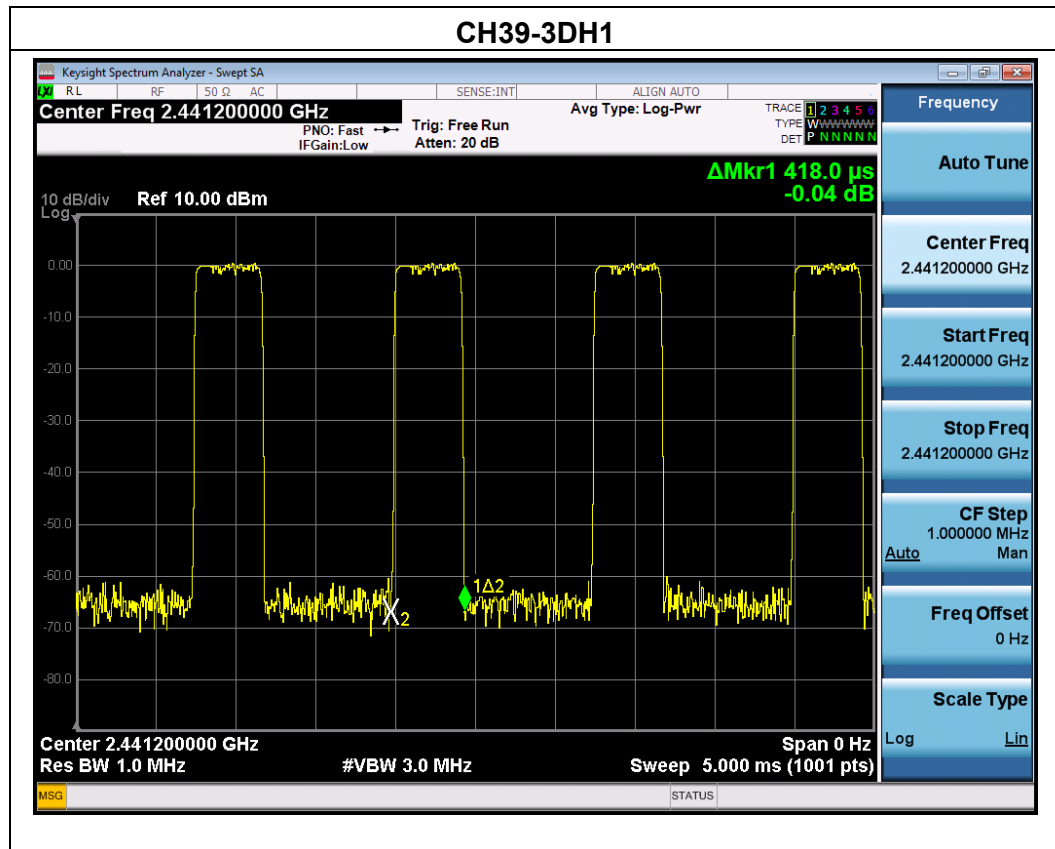
Data Packet	Frequency	Pulse Duration	Dwell Time	Limits
		(ms)	(s)	(s)
2DH1	2441 MHz	0.43	0.14	0.4
2DH3	2441 MHz	1.70	0.27	0.4
2DH5	2441 MHz	2.94	0.31	0.4

Test plot as follows as below:

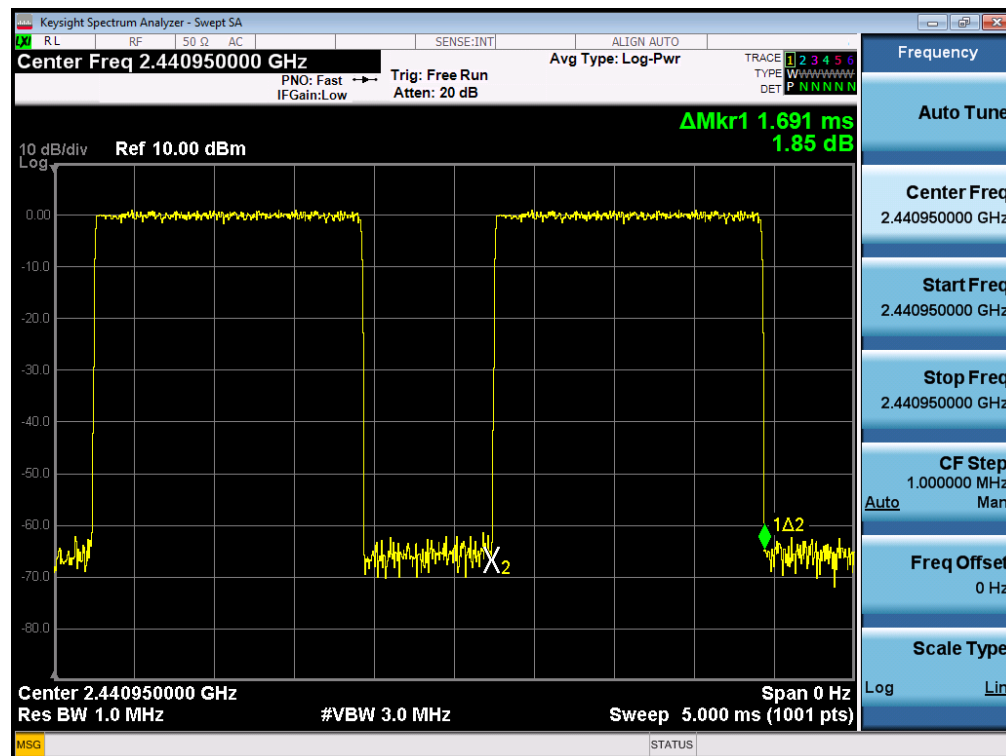




Data Packet	Frequency	Pulse Duration	Dwell Time	Limits
		(ms)	(s)	(s)
3DH1	2441 MHz	0.42	0.13	0.4
3DH3	2441 MHz	1.69	0.27	0.4
3DH5	2441 MHz	2.94	0.31	0.4



CH39-3DH3



CH39-3DH5

