Test Report for FCC & IC

IC : 10330A-CS50
FCC ID : YW6CS50

Report Number		ESTF151403-004		
Applicant	Company name	Conversion Sound Inc.		
	Address	960 N. Northwest Hwy, Park Ridge, Illinois United States		
	Telephone	1-847-939-6101		
Product	Product name	Bluetooth headset		
	Model No.	CS50	Manufacturer	Samsin innotec Co., Ltd.
	Serial No.	NONE	Country of origin	KOREA
Test date	2014-02-03 ~ 2014-02-15		Date of issue	24-Mar-14
Testing location	ESTECH Co., Ltd. 97-1, Hoeeok-ri, Majang-myeon, Icheon-si, Gyeonggi-do, Korea			
Standard	FCC PART 15 Subpart C (15.247):2010 , ANSI C 63.4(2009) , DA 00-705 , IC RSS-210 Issue8 :2010			
Measurement facility registration number		915135	IC Number	4475B-2
Tested by	Engineer S.B.Lee (Signature)			
Reviewed by	Engineering Manager J.M.Yang (Signature)			
Abbreviation	OK, Pass = Passed, Fail = Failed, N/A = not applicable			

* Note
- This test report is not permitted to copy partly without our permission
- This test result is dependent on only equipment to be used
- This test result based on a single evaluation of one sample of the above mentioned
- Basic Model : CS50
-Additional Model : CS10i, CS50K, CS51, CS55, CS11 (Classification based on the buyer, the same product)

Contents 1

Contents 2

1. Laboratory Information

1.1 General

This EUT (Equipment Under Test) has been shown to be capable of compliance with the applicable technical standards and is tested in accordance with the measurement procedures as indicated in this report.
ESTECH Lab attests to accuracy of test data. All measurement reported herein were performed by ESTECH Co., Ltd.
ESTECH Lab assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

1.2 Test Lab.

Corporation Name : ESTECH Co., Ltd.

Head Office : Rm 1015, World Venture Center II, 426-5, Gasan-dong, Geumcheon-gu, Seoul, Korea

EMC/Telecom/Safety Test Lab : 97-1, Hoeeok-ri, Majang-myeon, Icheon-si, Gyeonggi-do, Korea

1.3 Official Qualification(s)

KCC : Granted Accreditation from Ministry of Information & Communication for EMC, Safety and Telecommunication
KOLAS : Accredited Lab By Korea Laboratory Accreditation Schema base on CENELEC requirements
FCC : Conformity Assessment Body(CAB) with registration number 659627 under APEC TEL MRA between the RRA and the FCC
VCCI : Granted Accreditation from Voluntary Control Council for Interference from ITE

2. Description of EUT

2.1 Summary of Equipment Under Test (Bluetooth)

Modulation Type	: 8DPSK, GFSK
Transfer Rate	: 3 Mbps
Number of Channel	: 79 ch
Channel Spacing	: 1 MHz
PEAK Output Power	: GFSK : 7.2277 mW 8DPSK : 2.9107 mW
Rating	: INPUT : 5 Vd.c., (Battery)
Receipt Date	: 3-Jan-14
X-tal list(s) or Frequencies generated	: The highest operating frequency is 2480 MHz(Bluetooth) XTAL : 26 MHz , Blutooth : 2.4 GHz

2.2 General descriptions of EUT

- General

This spec sheet defines the specification for the CS50 Personal Sound Amplifier with Bluetooth.

(Models: CS50)

- Product Features

1. MMI (Man Machine Interface)
   - Buttons : 2 pcs [Volume, Program Select]
   - LED : 1 pcs Red / Green (On/ Off, Low Battery, Pairing, Operating)
   - Speaker : 1 pcs
   - Microphone : 2 pcs
2. Features
   - Amplification of ambient sounds
   - Select from 3 preset amplification profiles
   - Adjust amplification volume
   - Adjust settings over Bluetooth connection using customization apps
   - Bluetooth 4.0 Specification Compliant
   - Class 2 support
   - Profiles: A2DP, HSP, HFP, GATT
   - Answer/End
   - Call Reject
   - Low power consumption
   - Interchangeable rechargeable Li-Polymer Battery
   - LED light for operating status

3. Test Standards

Test Standard : FCC PART 15 Subpart C (15.247) : 2010 & IC RSS-210 Issue8 : 2010

This Standard sets out the regulations under which an intentional, unintentional, or incidental radiator may be operated without an individual license. It also contains the technical specifications, administrative requirements and other conditions relating to the marketing of Part 15 devices.

Test Method : ANSI C 63.4 (2009) & DA 00-705

This standard sets forth uniform methods of measurement of radio-frequency (RF) signals and noise emitted from both unintentional and intentional emitters of RF energy in the frequency range 9 kHz to 40 GHz. Methods for the measurement of radiated and AC power-line conducted radio noise are covered and may be applied to any such equipment unless otherwise specified by individual equipment requirements. These methods cover measurement of certain decides that deliberately radiate energy, such as intentional emitters, but does not cover licensed transmitters. This standard is not intended for certification/approval of avionic equipment or for industrial, scientific, and medical (ISM) equipment These method apply to the measurement of individual units or systems comprised of multiple units

Summary of Test Results

Applied Satandard : 47 CFR Part 15 Subpart C & RSS-210 Part I and II					remark
FCC Standard	IC Standard	Test Type	Result	Remark	Limit
15.207	RSS-Gen 7.2.2	AC Power Conducted Emission	N/A	Meet the requirement	
15.205 & 15.209	A8.5	Intentional Radiated Emission	Pass	Meet the requirement	
15.247(a)(1)	A8.1(b),A8.1(a) RSS-Gen 4.6.1	Carrier Frequency Separation & 20 Bandwidth ,99% Bandwidth	Pass	Meet the requirement	>25 kHz
15.247(b)	A8.4(2)	Maximum Peak ouput power	Pass	Meet the requirement	30dBm(1W)
15.247(a)(1)(ii)	A8.1(d)	Number of Hopping Frequency	Pass	Meet the requirement	>75
15.247(c)	A8.5	Transmitter Radiated Emission	Pass	Meet the requirement	
15.247(a)(1)(iii)	A8.1(d)	Time of Occupancy (Dwell Time)	Pass	Meet the requirement	<400ms
15.247(d)	A8.5	Band Edge Measurement	Pass	Meet the requirement	
15.107	RSS-Gen 7.2.2	Receiver conducted Emission	N/A	Meet the requirement	
15.109	RSS-Gen 7.2.3.2	Receiver radiated emission	Pass	Meet the requirement	

4. Measurement Condition

4.1 EUT Operation

a. Channel

Ch.	Frequency	Ch.	Frequency
0	2402 MHz	40	2442 MHz
1	2403 MHz	41	2443 MHz
2	2404 MHz	42	2444 MHz
3	2405 MHz	43	2445 MHz
4	2406 MHz	…	…
…	…	78	2480 MHz
39	2441 MHz		

b. Measurement Channel :Low(2402 MHz), Middle(2441 MHz),High(2480 MHz)

c. Test Mode : 8DPSK, GFSK(worst case)

d. Test rate :3 Mbps

4.2 EUT Operation.

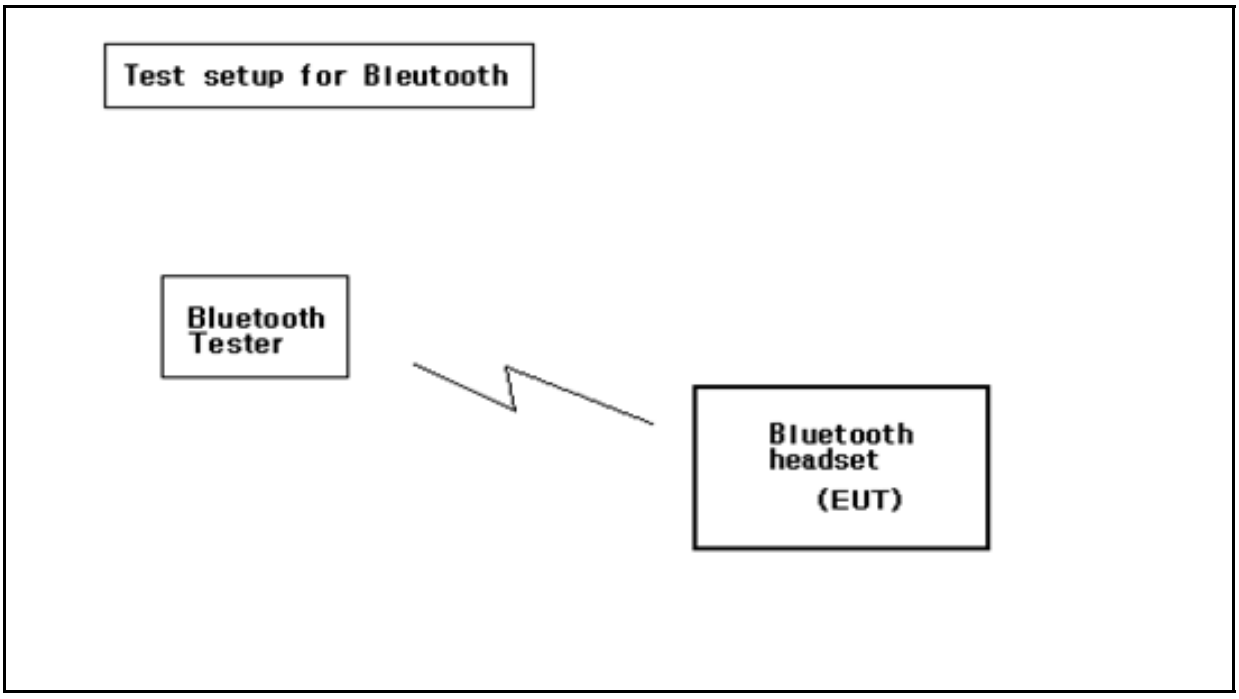
* The EUT was in the following operation mode during all testing

* The operational conditions of the EUT was determined by the manufacturer according to the typical use of the EUT with respect to the expected highest level of emission

* The EUT was measured under transmitting / receiving condition continuously at specific channel frequency.

* The EUT was measured up to tenth harmonic or 40 GHz of the highest operating frequencies.

4.3 Configuration and Peripherals



4.4 EUT and Support equipment

Equipment Name	Model Name	S/N	Manufacturer	Remark (FCC ID)
Bluetooth headset	CS50	NONE	Samsin innotec Co., Ltd.	EUT
Bluetooth Tester	TC-3000A	3000A570224	TESCOM	

4.5 Cable Connecting

Start Equipment		End Equipment		Cable Standard		Remark
Name	I/O port	Name	I/O port	Length	Shielded	
Bluetooth headset	Wireless(BT)	Bluetooth Tester	Wireless(BT)	-	-	

5. Carrier Frequency Separation

5.1 Test procedure

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

5.2 Test instruments and measurement setup

The spectrum analyzer is set to as following.

. RBW= 30KHz

. VBW= 300KHz

. Span= 3MHz

. Sweep= suitable duration based on the EUT specification.

20dB Bandwidth Test Instruments

Description	Model	Serial Number	Cal. Due Date
Spectrum Analyzer	E4440A	US41421291	2015-01-23
-Spectrum Analyzer <=> EUT	Loss: 1.0dB	-	

5.3 Measurement results

EUT	Bluetooth headset	MODEL	CS50
MODE	GFSK	ENVIRONMENTAL CONDITION	26.0 ℃, 43.0 % R.H.
INPUT POWER	5Vd.c.		

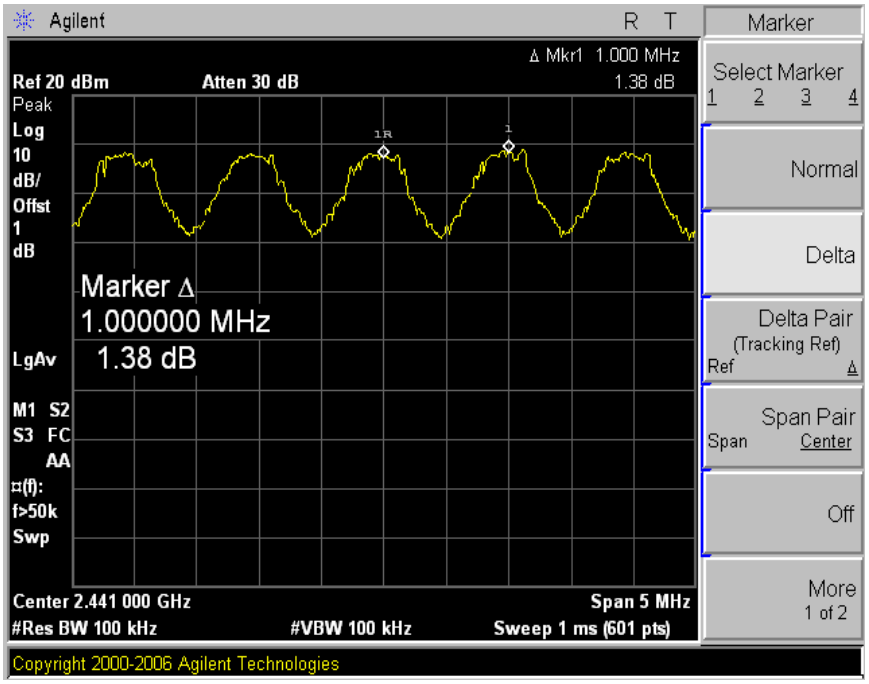
CHANNEL	Channel Frequency (MHz)	Bandwidth at 99% (kHz)	Bandwidth at 20dB below(kHz)	Channel Separation (kHz)	Limit (kHz)	PASS/FAIL
0	2402	894	957	1000	638	PASS
39	2441	892	947	1000	631	PASS
78	2480	856	897	1000	598	PASS

(8DPSK)

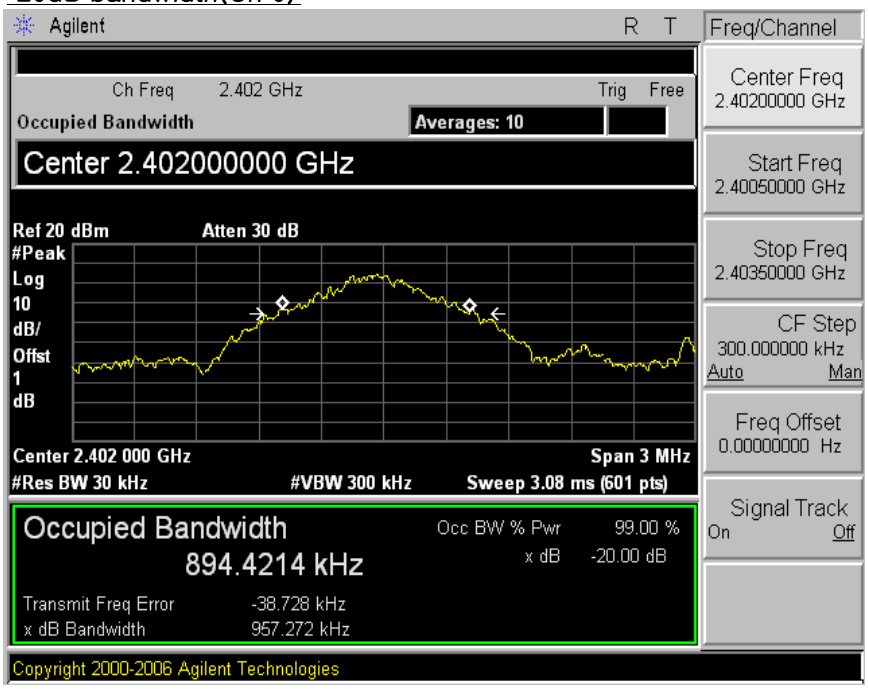
CHANNEL	Channel Frequency (MHz)	Bandwidth at 99% (MHz)	Bandwidth at 20dB below(kHz)	Channel Separation (kHz)	Limit (kHz)	PASS/FAIL
0	2402	1.173	1244	1000	829	PASS
39	2441	1.178	1276	1000	851	PASS
78	2480	1.173	1294	1000	863	PASS

5.4 Trace data (GFSK)

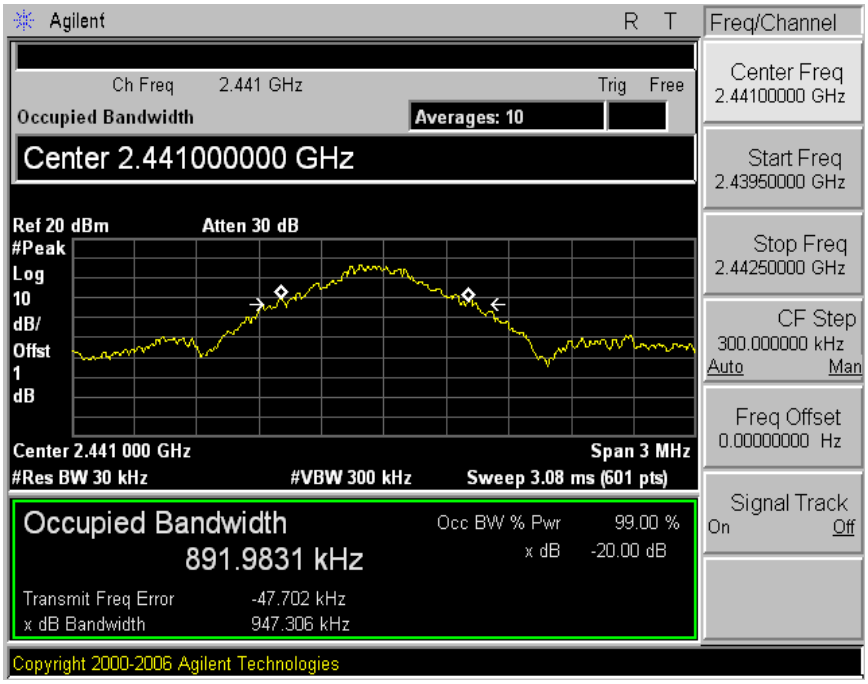
Channel Separation



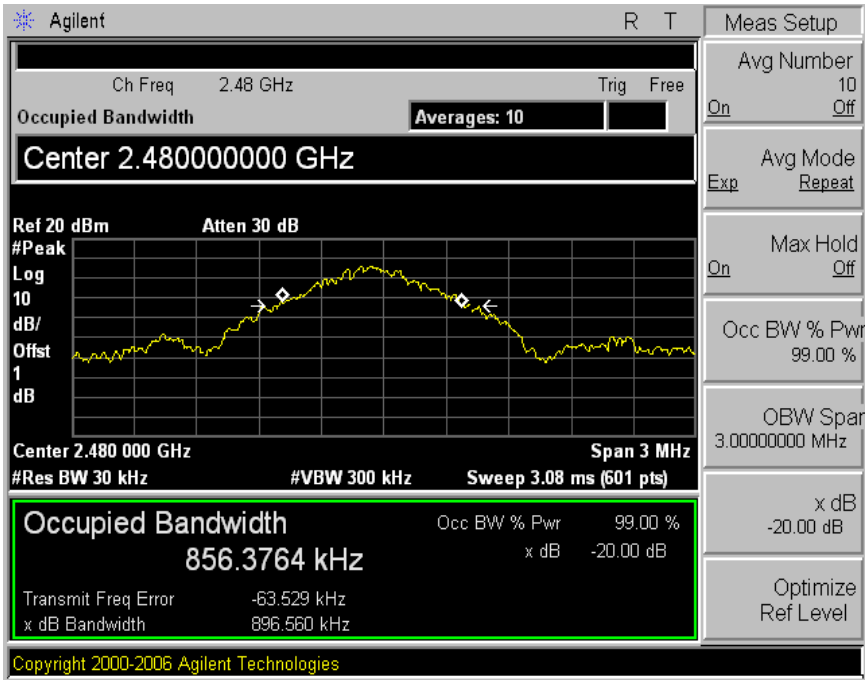
20dB bandwidth(Ch 0)



20dB bandwidth(CH 39)

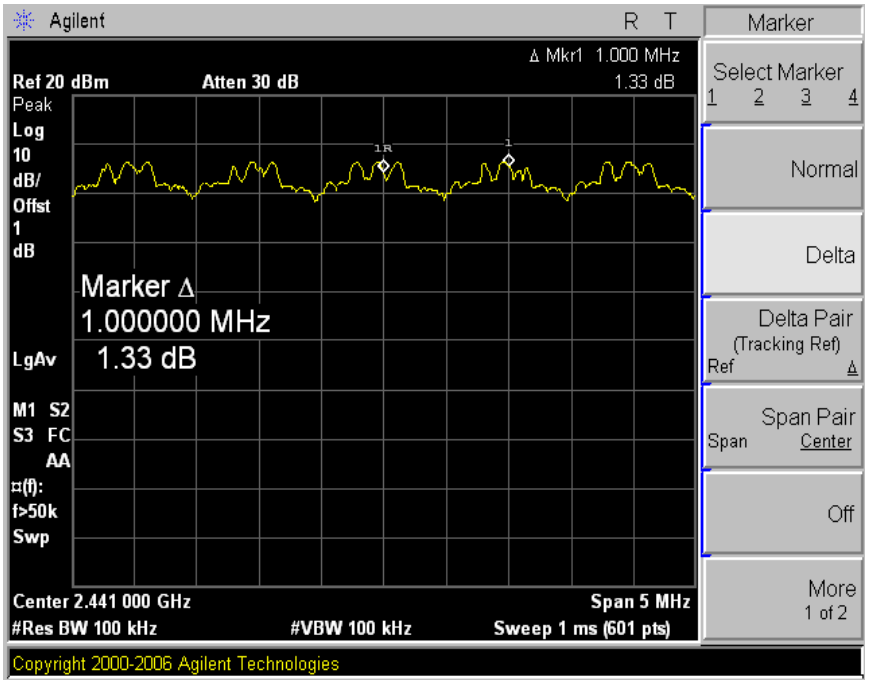


20dB bandwidth(CH 78)

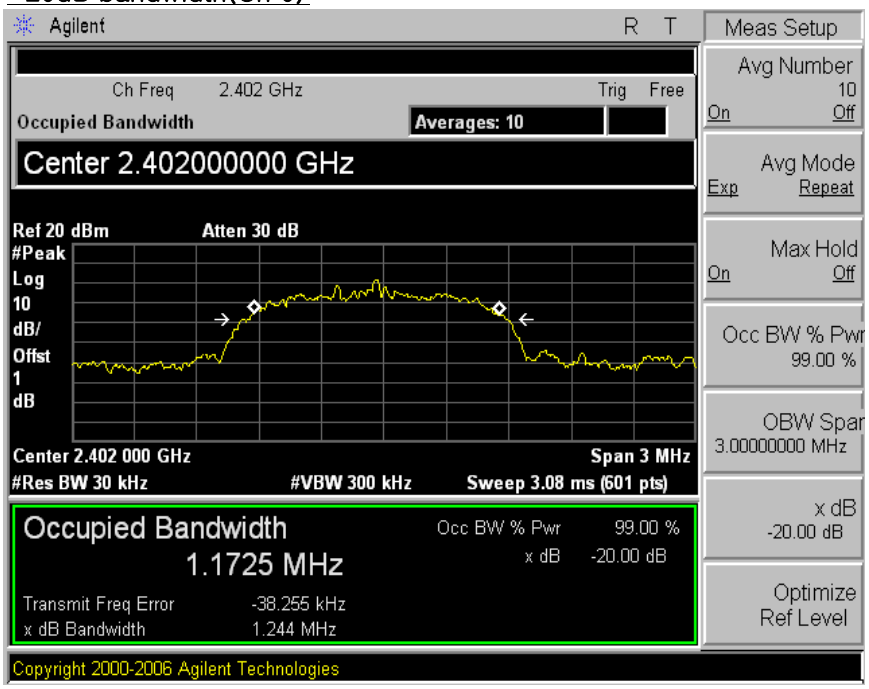


(8DPSK)

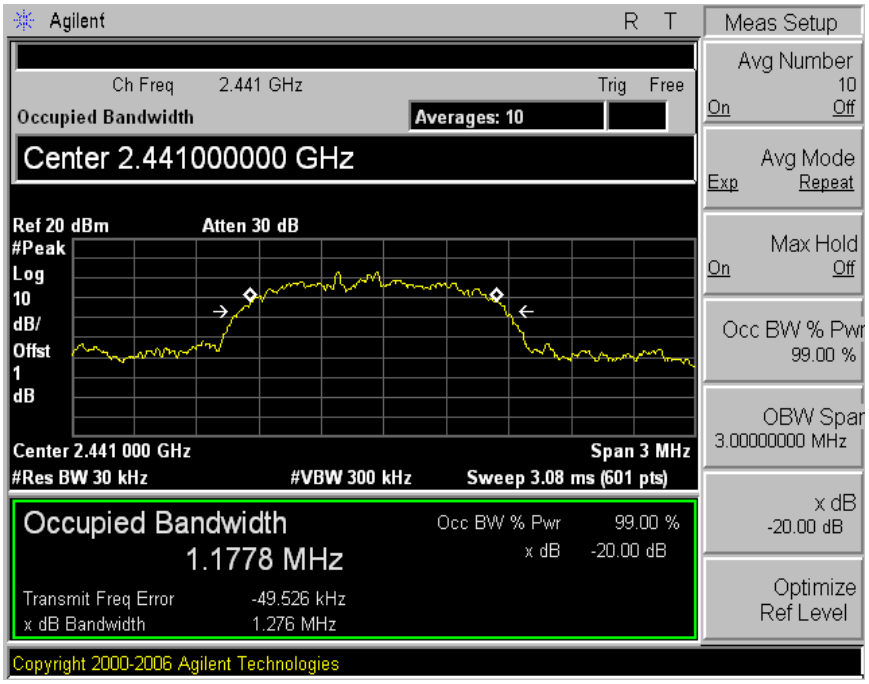
Channel Separation



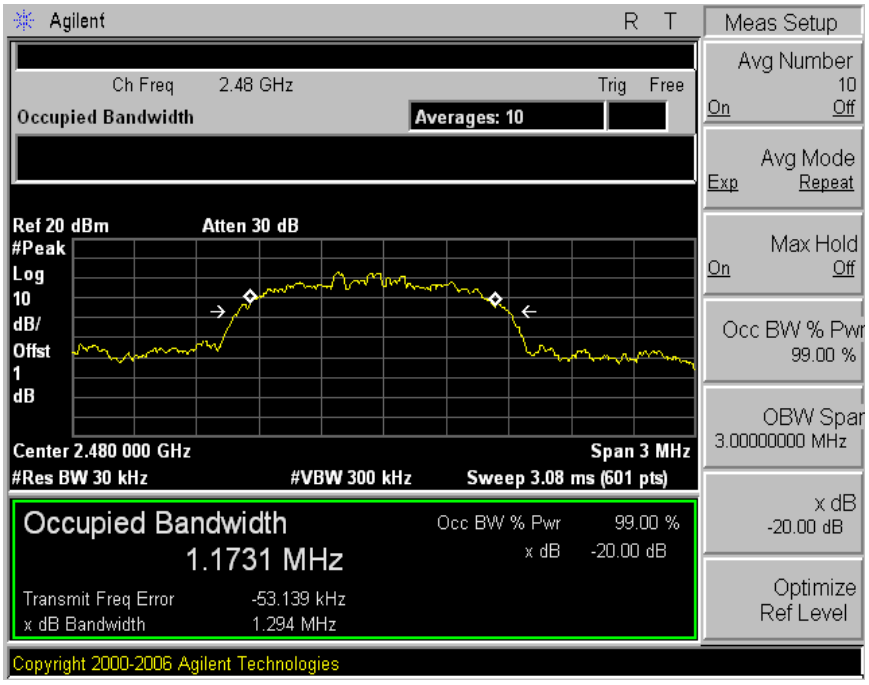
20dB bandwidth(Ch 0)



20dB bandwidth(CH 39)



20dB bandwidth(CH 78)



6. MAXIMUM PEAK OUTPUT POWER

6.1 Test procedure

The transmitter antenna terminal is connected to the input of a Power Sensor. Measurement is made while EUT is operating in transmission mode at the appropriate center frequency. The maximum peak output power measurement is 30dBm.

Description	Model	Serial Number	Cal. Due Date
Power Meter	NRVS	849622/045	2015-01-13
Power Sensor	NRV-251	325948/013	2015-01-13
-Spectrum Analyzer <=> EUT	Loss: 1.0dB	-	

6.2 Measurement results

EUT	Bluetooth headset	MODEL	CS50
MODE	GFSK,8DPSK DH5	ENVIRONMENTAL CONDITION	24.0 ℃, 43.0 % R.H.
INPUT POWER	5Vd.c.		

GFSK

CHANNEL	Channel Frequency (MHz)	Peak Power Output(dBm)		Limit[mW]	PASS/ FAIL
		(dBm)	(mW)		
0	2402	6.28	4.2462	125	PASS
39	2441	8.59	7.2277	125	PASS
78	2480	8.57	7.1945	125	PASS

8DPSK

CHANNEL	Channel Frequency (MHz)	Peak Power Output(dBm)		Limit[mW]	PASS/ FAIL
		(dBm)	(mW)		
0	2402	1.07	1.2794	125	PASS
39	2441	4.64	2.9107	125	PASS
78	2480	4.37	2.7353	125	PASS

Note : GFSK mode is max power in three different modulations.

7. Number of Hopping Frequency

7.1 Test procedure

According to §15.247(a)(1)(ii), Frequency hopping systems operating in the 2400MHz-2483.5MHz bands shall use at least 75 hopping frequencies.

7.2 Test instruments and measurement setup

The spectrum analyzer is set to as following.

. RBW= 300KHz

. VBW= 300KHz

. Span= the frequency band of operation

. Sweep= suitable duration based on the EUT specification.

The Number of Hopping Frequency Test Instruments

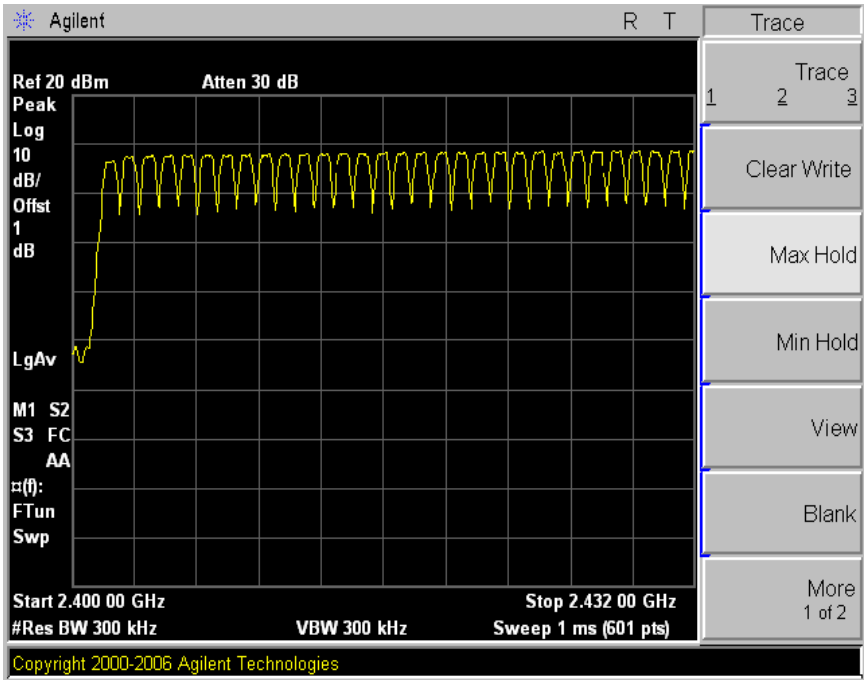
Description	Model	Serial Number	Cal. Due Date
Spectrum Analyzer	E4440A	US41421291	2015-01-23
-Spectrum Analyzer <=> EUT	Loss: 1.0dB		

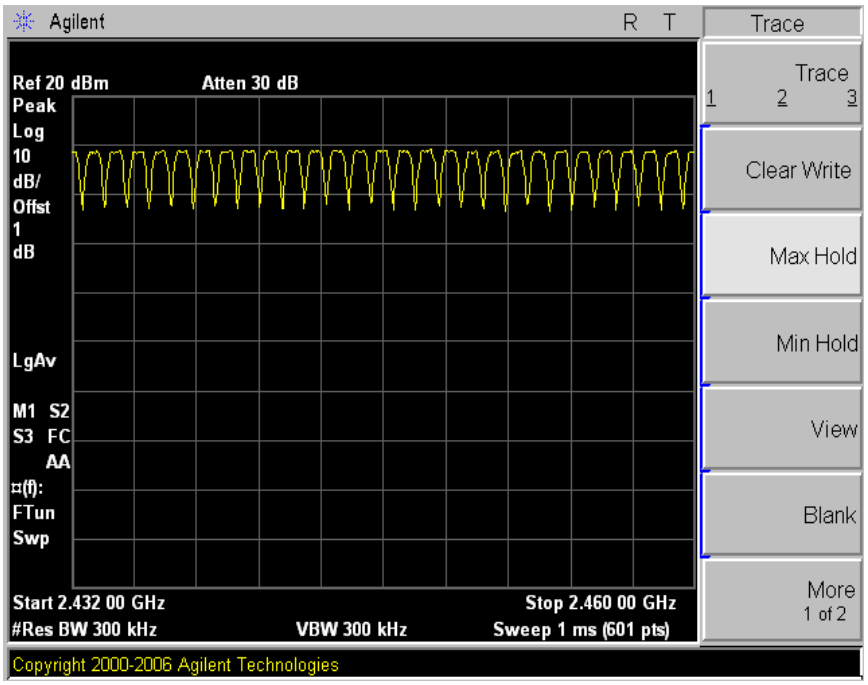
7.3 Measurement results

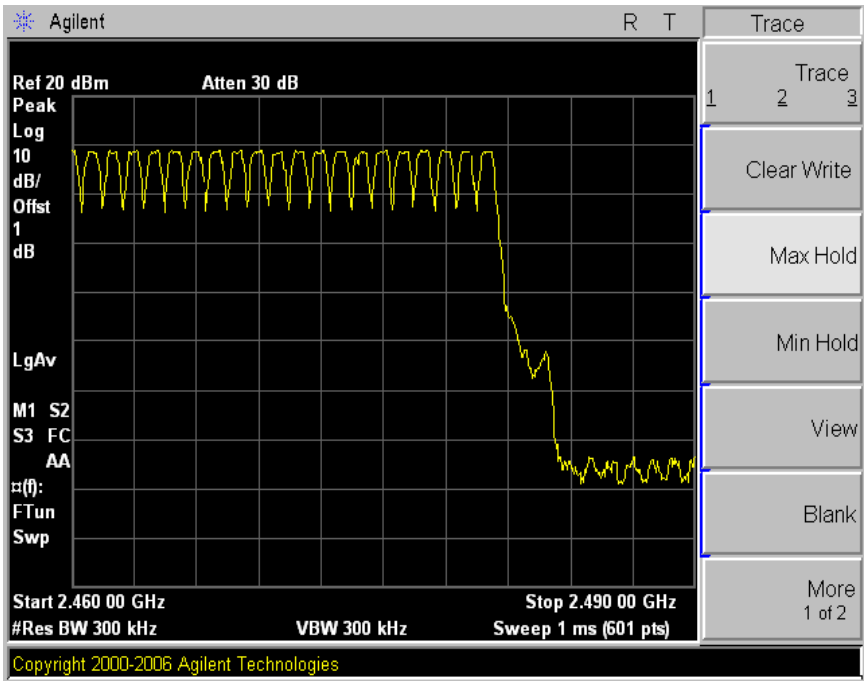
EUT	Bluetooth headset	MODEL	CS50
MODE	GFSK	ENVIRONMENTAL CONDITION	26.0 ℃, 43.0 % R.H.
INPUT POWER	5Vd.c.		

Number of CH	Limit (Number of CH)	PASS/FAIL
79	>75	PASS

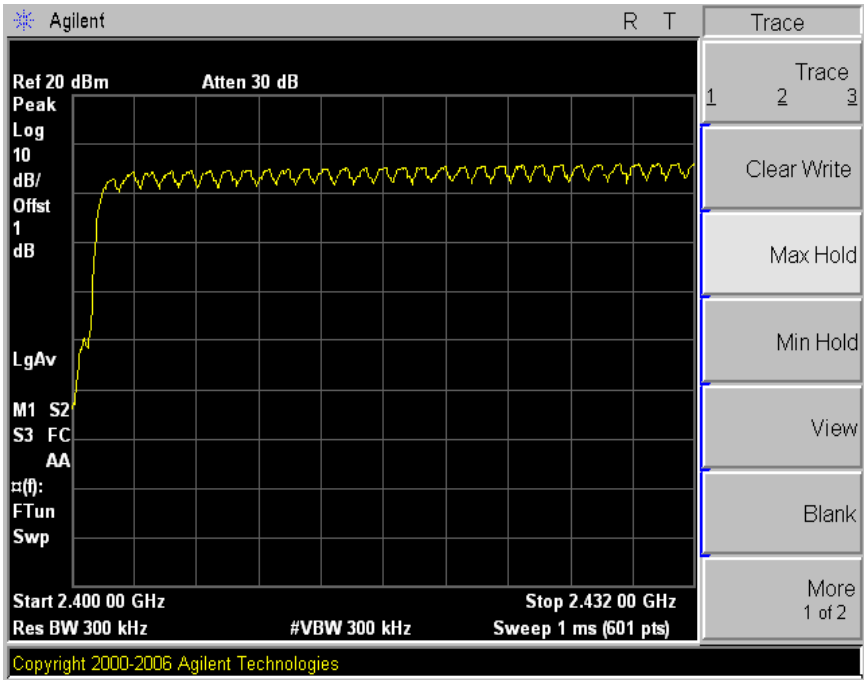
7.4 Trace data(GFSK)

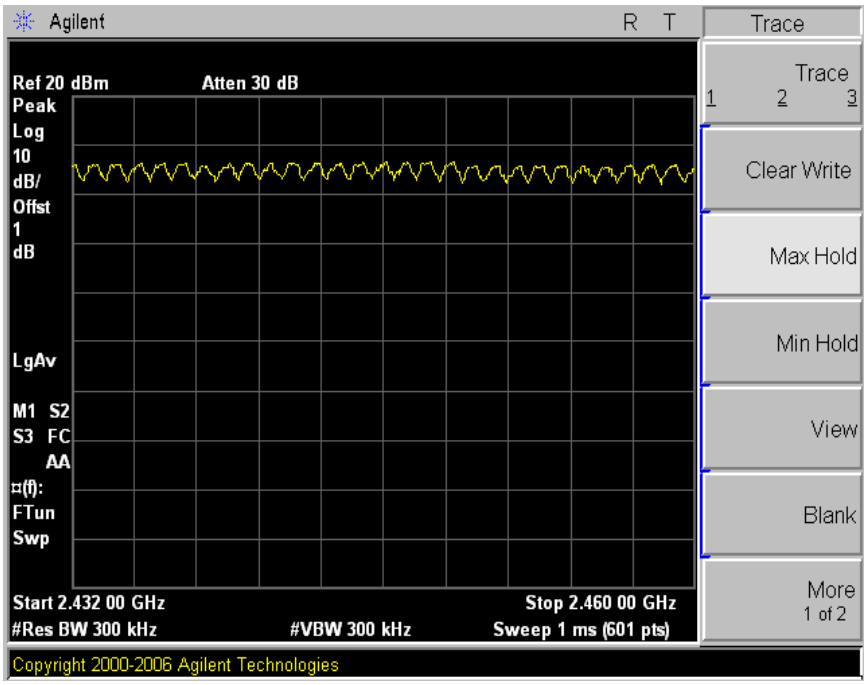


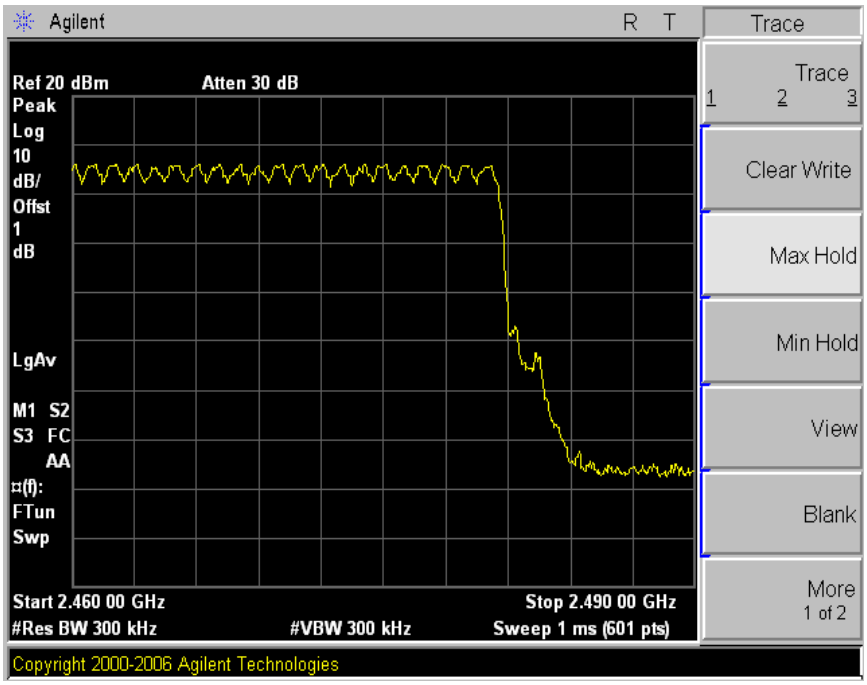



Agilent
R T
Trace
Ref 20 dBm
Atten 30 dB
Peak
Log
10
dB/
Offst
1
dB
LgAv
M1 S2
S3 FC
AA
¤(f):
FTun
Swp
Start 2.460 00 GHz
#Res BW 300 kHz
VBW 300 kHz
Stop 2.490 00 GHz
Sweep 1 ms (601 pts)
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2
Copyright 2000-2006 Agilent Technologies

7.4 Trace data(8DPSK)






Agilent
R T
Trace
Ref 20 dBm
Atten 30 dB
Peak
Log
10
dB/
Offst
1
dB
LgAv
M1 S2
S3 FC
AA
¤(f):
FTun
Swp
Start 2.460 00 GHz
#Res BW 300 kHz
#VBW 300 kHz
Stop 2.490 00 GHz
Sweep 1 ms (601 pts)
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2
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8. Time of Occupancy (Dwell Time)

8.1 Test procedure

According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands. The average time of occupancy on any channels shall not greater than 0.4 s within a period 0.4 s multiplied by the number of hopping channels employed.

8.2 Test instruments and measurement setup

The spectrum analyzer is set to as following.

. RBW= 1MHz

. VBW≥RBW

. Span= zero span, centered on a hoppong channel

. Sweep = as necessary to capture the entire dwell time per hoppong channel

. Detector function = Peak

. Trace = Max hold

The Time of Occupancy Test Instruments

Description	Model	Serial Number	Cal. Due Date
Spectrum Analyzer	E4440A	US41421291	2015-01-23
-Spectrum Analyzer <=> EUT	Loss:1.0dB	-	

8.3 Measurement results

EUT	Bluetooth headset	MODEL	CS50
MODE	GFSK	ENVIRONMENTAL CONDITION	26.0 ℃, 43.0 % R.H.
INPUT POWER	5Vd.c.		

A. DH1 Mode
One period for each particular channel : 0.422 ms X 320.1 = 135.08 ms

Channel	Pulse Time(ms)	Limit(ms)	PASS/FAIL
39	135.08	400	PASS

Calculation:The Bluetooth system hops at a rate of 1600 times per second. This means there are 1600 timeslots in one second, the DH1 data rate operates on a one-slot transmission and one-slot receiving basis. Thus there are 1600/(1+1)=800 transmissions per second. In one period for each particular channel there are 10.13x31.6=320.1 times of tramsmissions.

B. DH3 Mode
One period for each particular channel : 1.700 ms X 159.9 = 271.83 ms

Channel	Pulse Time(ms)	Limit(ms)	PASS/FAIL
39	271.83	400	PASS

Calculation: The Bluetooth system hops at a rate of 1600 times per second. This means there are 1600 timeslots in one second, the DH3 data rate operates on a three-slot transmission and one-slot receiving basis. Thus there are 1600/(3+1)=400 transmissions per second. In one period for each particular channel there are 5.06x31.6=159.9 times of tramsmissions.

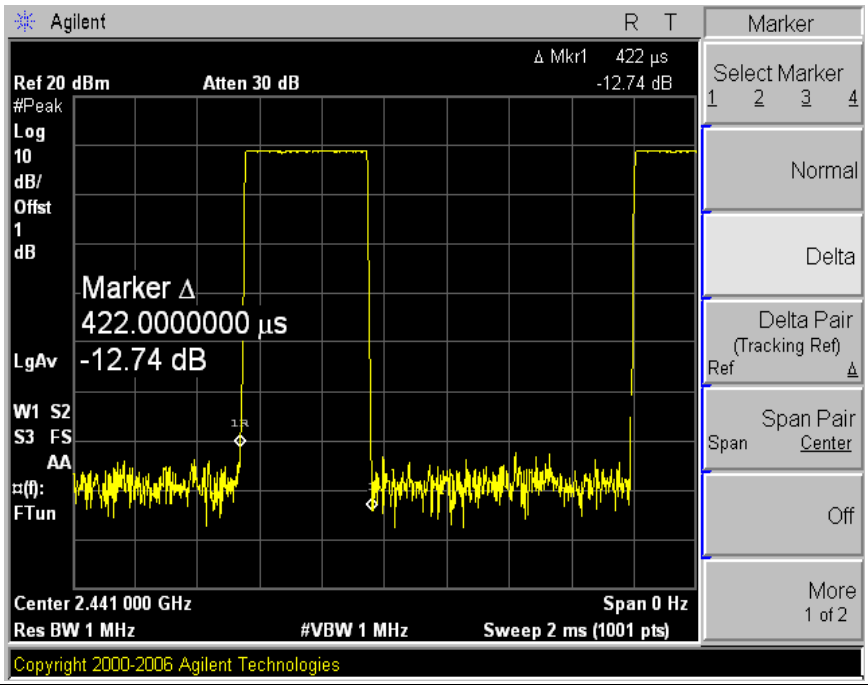
C. DH5 Mode
One period for each particular channel : 2.950 ms X 106.81 = 315.09 ms

Channel	Pulse Time(ms)	Limit(ms)	PASS/FAIL
39	315.09	400	PASS

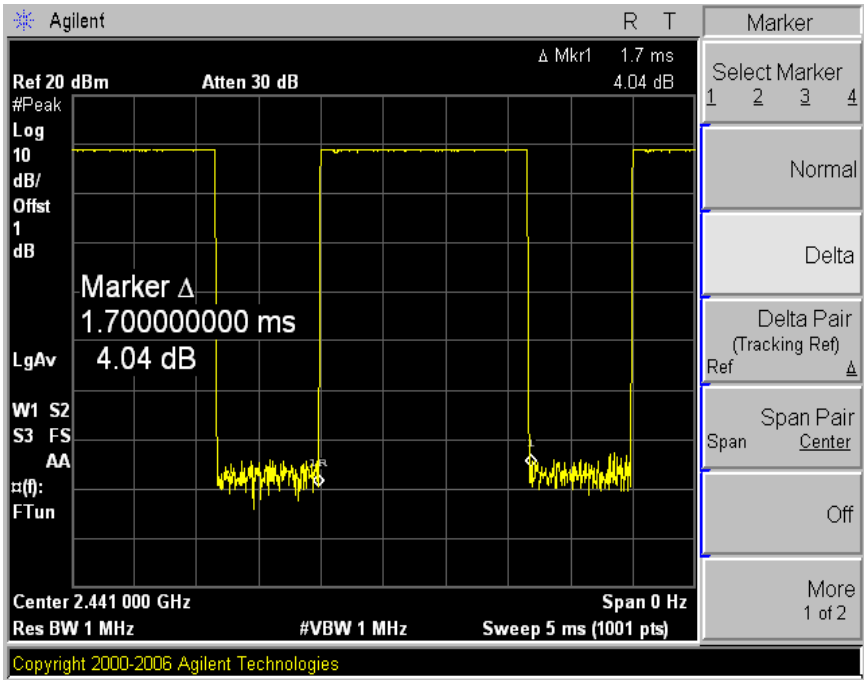
Calculation: The Bluetooth system hops at a rate of 1600 times per second. This means there are 1600 timeslots in one second, the DH5 data rate operates on a five-slot transmission and one-slot receiving basis. Thus there are 1600/(5+1)=266.7 transmissions per second. In one period for each particular channel there are 3.38x31.6=106.81 times of tramsmissions.

8.4 Trace data

DH1



DH3


Agilent
R T
Marker
Δ Mkr1 1.7 ms
4.04 dB
Ref 20 dBm
Atten 30 dB
#Peak
Log
10
dB/
Offst
1
dB
Marker Δ
1.700000000 ms
4.04 dB
LgAv
W1 S2
S3 FS
AA
¤(f):
FTun
Center 2.441 000 GHz
Span 0 Hz
Res BW 1 MHz
#VBW 1 MHz
Sweep 5 ms (1001 pts)
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Δ
Span Pair
Span Center
Off
More
1 of 2
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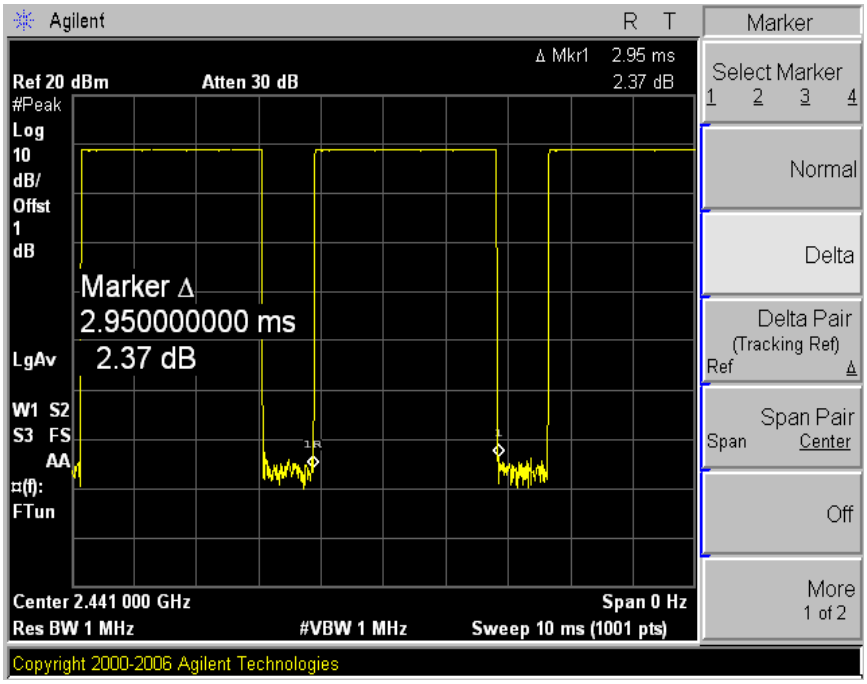
DH5


Agilent
R T
Marker
Δ Mkr1 2.95 ms
2.37 dB
Ref 20 dBm
Atten 30 dB
#Peak
Log
10
dB/
Offst
1
dB
Marker Δ
2.950000000 ms
2.37 dB
LgAv
W1 S2
S3 FS
AA
¤(f):
FTun
Center 2.441 000 GHz
Span 0 Hz
Res BW 1 MHz
#VBW 1 MHz
Sweep 10 ms (1001 pts)
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Δ
Span Pair
Span Center
Off
More
1 of 2
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8DPSK

A. DH1 Mode

One period for each particular channel : 0.44 ms X 320.1 = 140.84 ms

Channel	Pulse Time(ms)	Limit (ms)	PASS/FAIL
39	140.84	400	PASS

B. DH3 Mode

One period for each particular channel : 1.70 ms X 159.9 = 271.83 ms

Channel	Pulse Time(ms)	Limit (ms)	PASS/FAIL
39	271.83	400	PASS

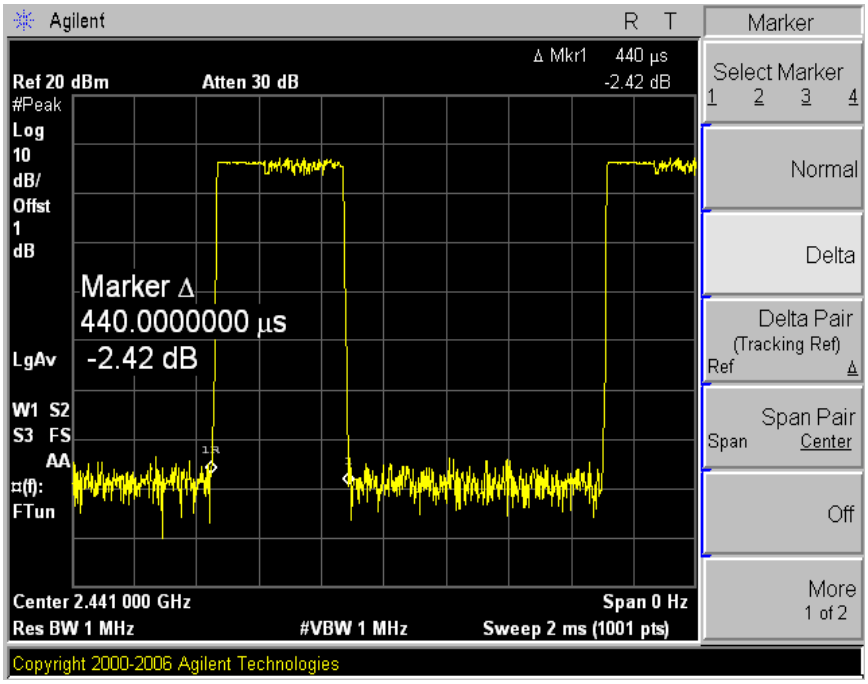
C. DH5 Mode

One period for each particular channel : 2.97 ms X 106.81 = 317.23 ms

Channel	Pulse Time(ms)	Limit (ms)	PASS/FAIL
39	317.23	400	PASS

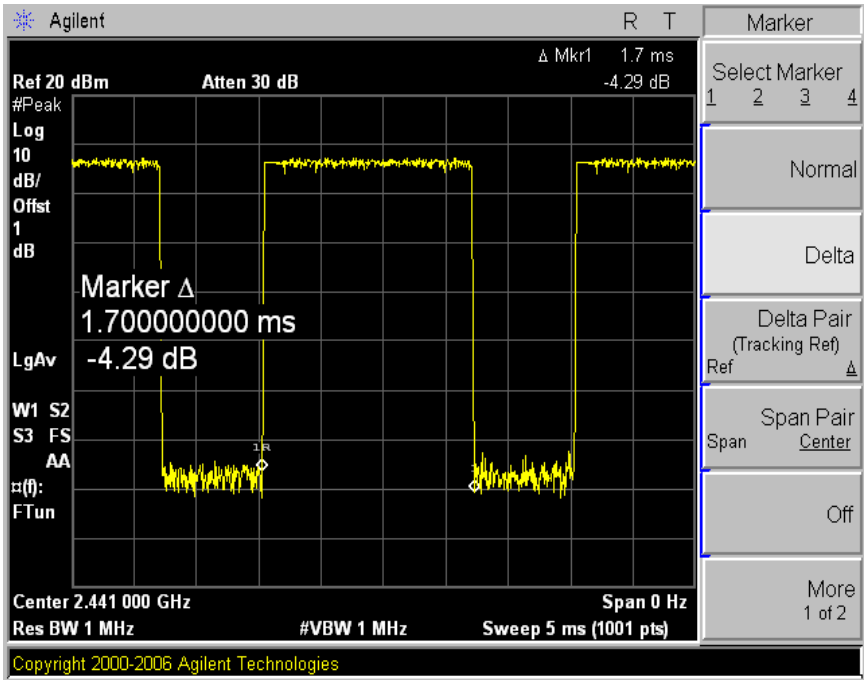
8.5 Trace data

DH1

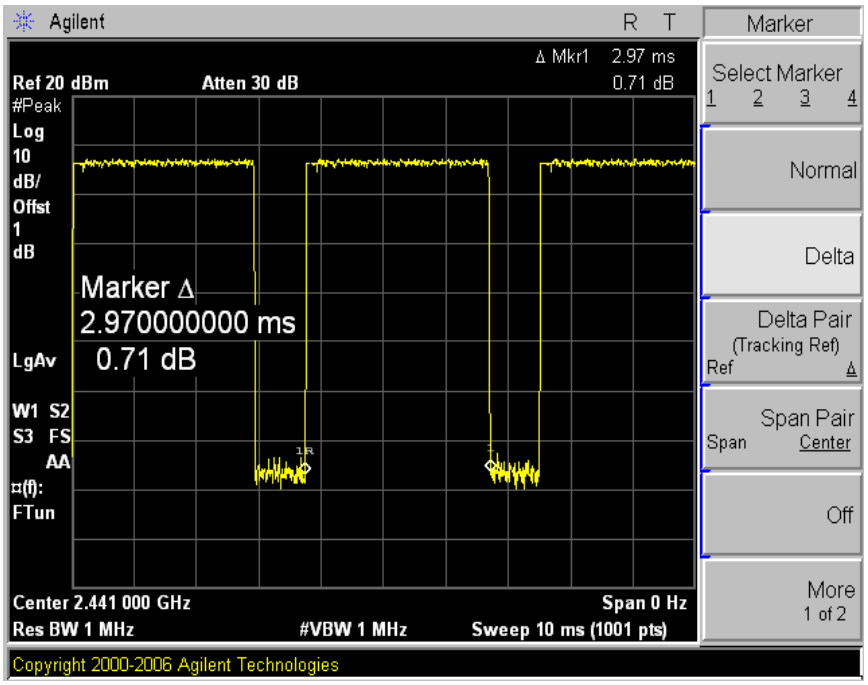


8DPSK

DH3



DH5



9. band-edge and out of band emissions.

9.1 Test procedure

The radio frequecy power at 20dB down from the highest inband power level is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency. The band edge&out of band emission shall be at least 20dB below of the highest inband power level.

9.2 Test instruments and measurement setup

The spectrum analyzer is set to as following.

. RBW= 100KHz

. VBW= >100KHz

. Span= suitable frequency span

. Sweep= suitable duration based on the EUT specification.

Band Edge&Out of Emission Test Instruments

Description	Model	Serial Number	Cal. Due Date
Spectrum Analyzer	E4440A	US41421291	2015-01-23
Signal Analyzer	FSV	100939	2015-01-23
-Spectrum Analyzer <=> EUT	Loss: 1.0dB		

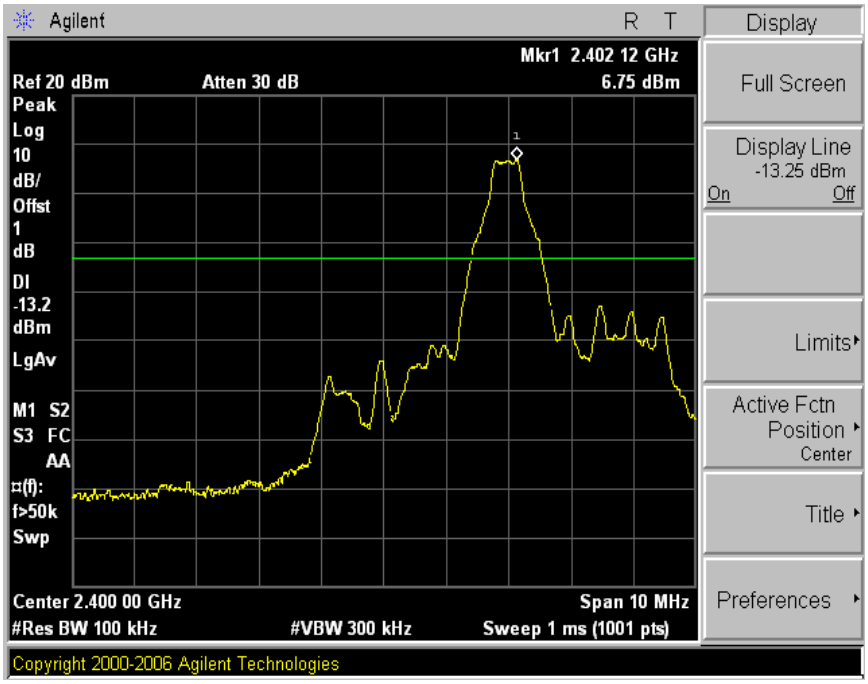
9.3 Measurement results of band-edge & out of emission

EUT	Bluetooth headset	MODEL	CS50
MODE	GFSK	ENVIRONMENTAL CONDITION	24.0 ℃, 43.0 % R.H.
INPUT POWER	5Vd.c.		

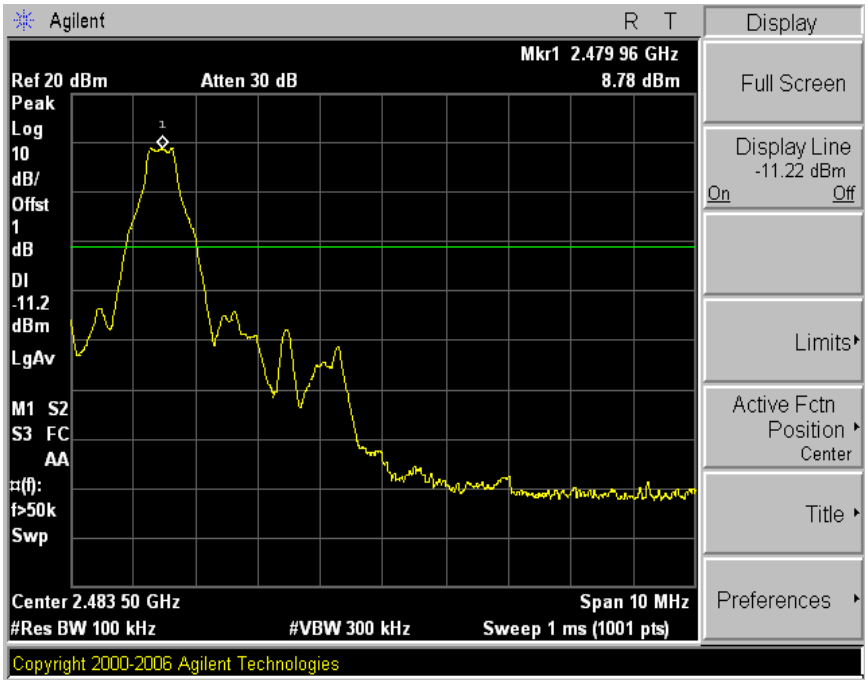
* Refer to attach spectrum analyzer data chart.

9.4 Trace data of band-edge & Out of Emission

CH0

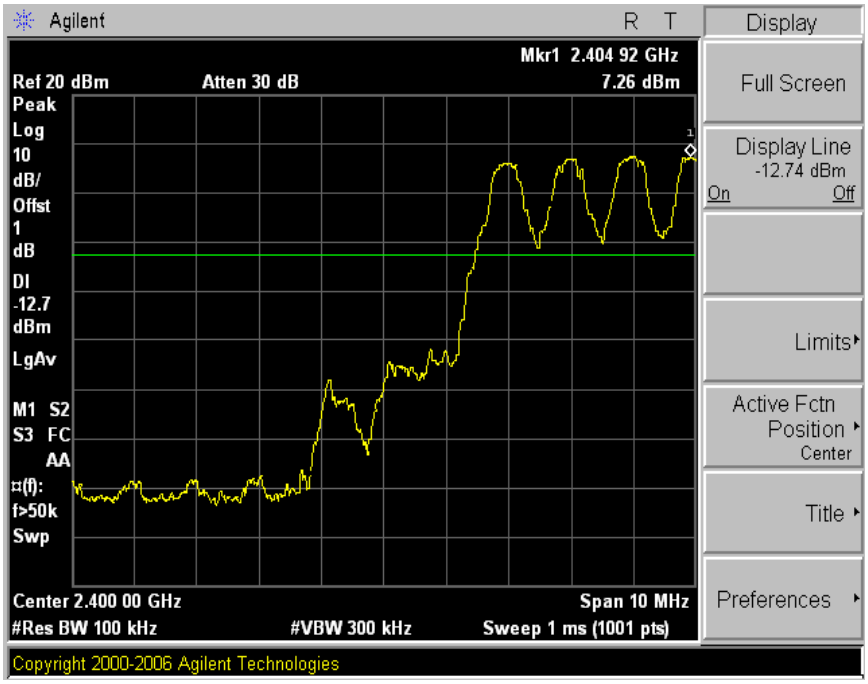


CH78

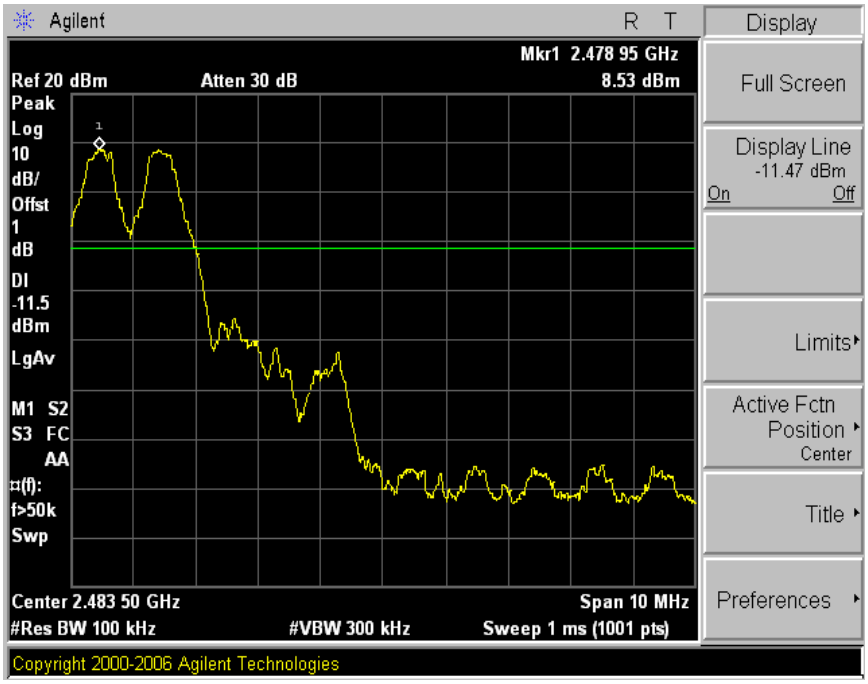


Hopping on

CH0

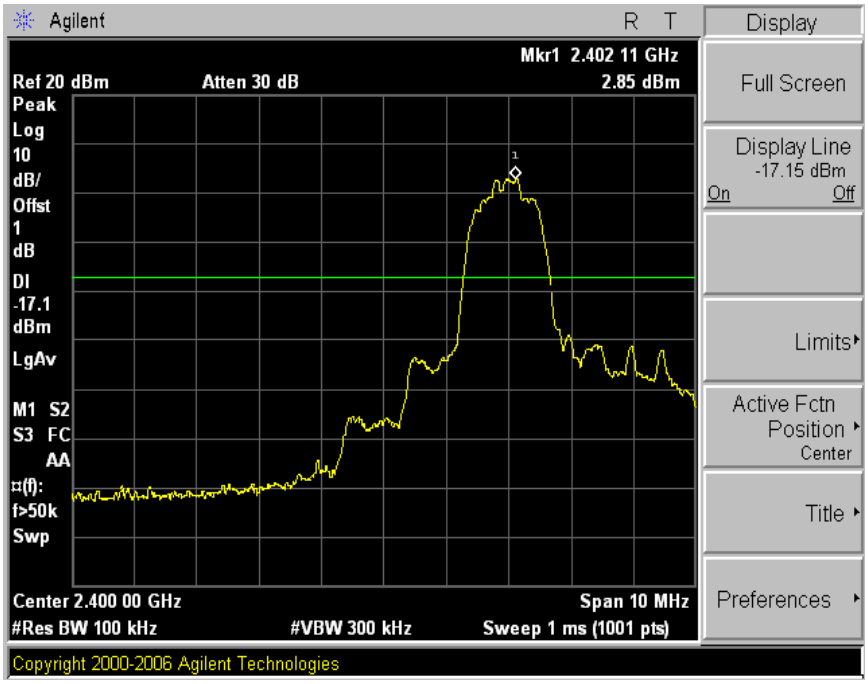


CH78

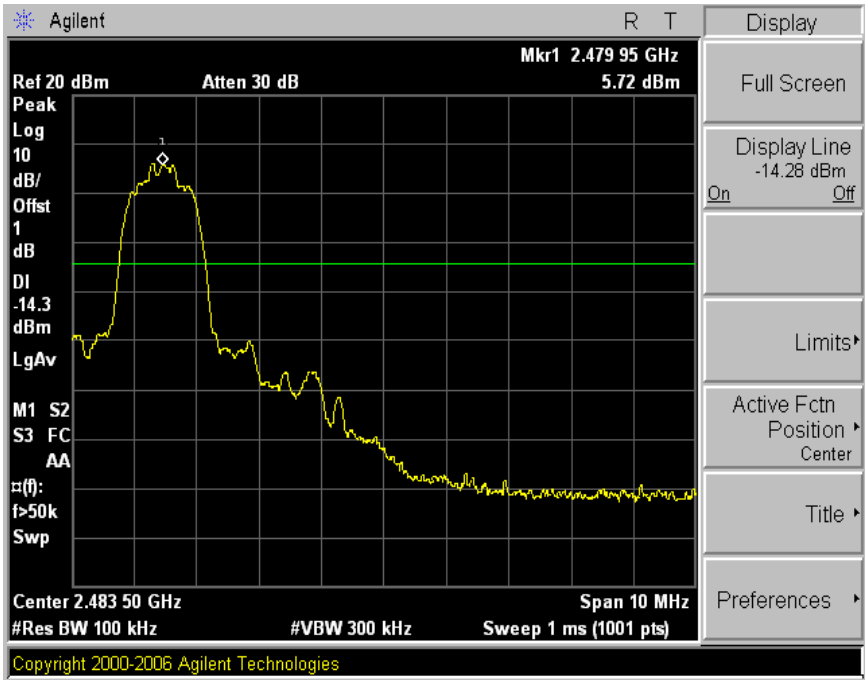


8DPSK

CH 0

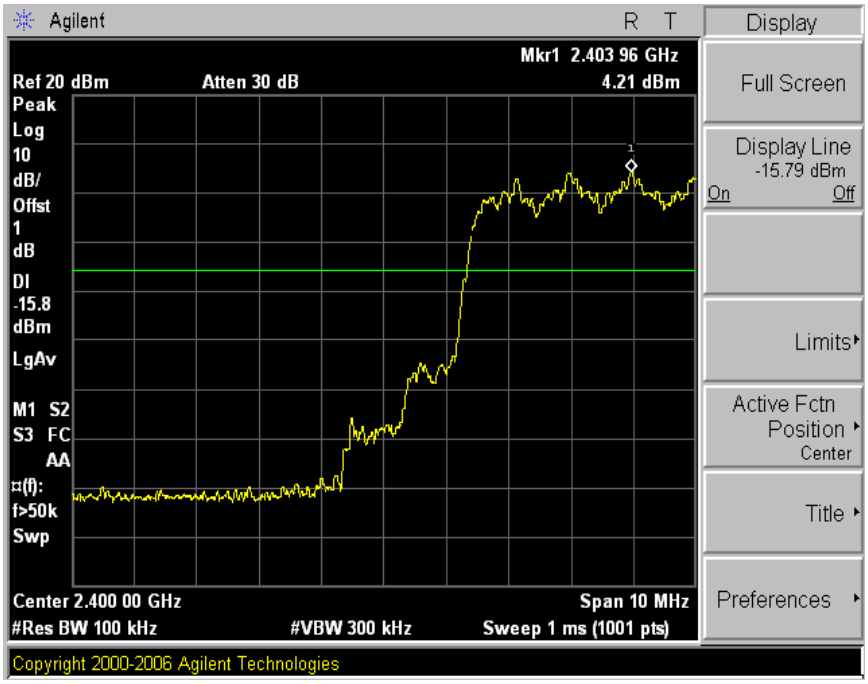


CH78

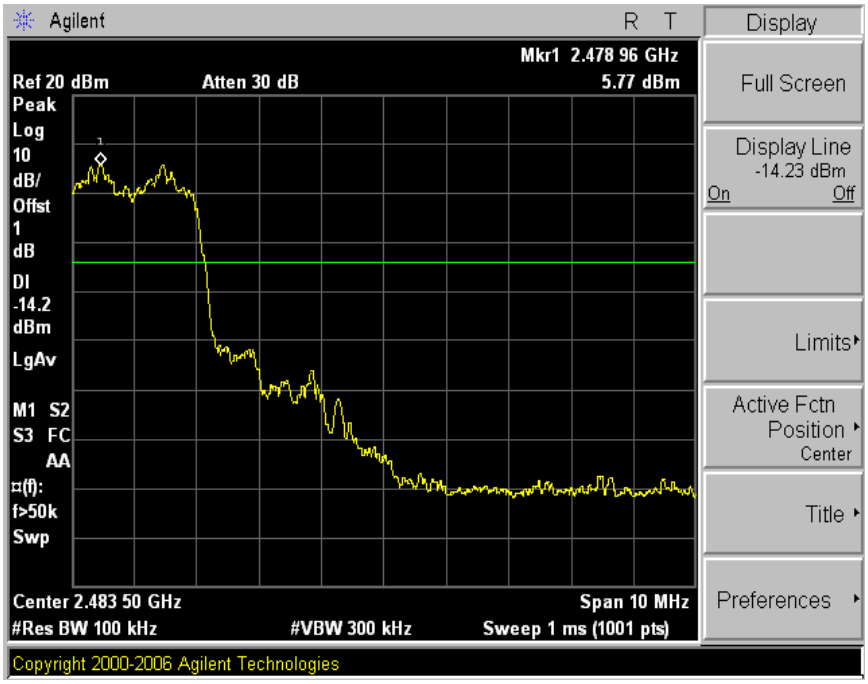


Hopping on

CH 0

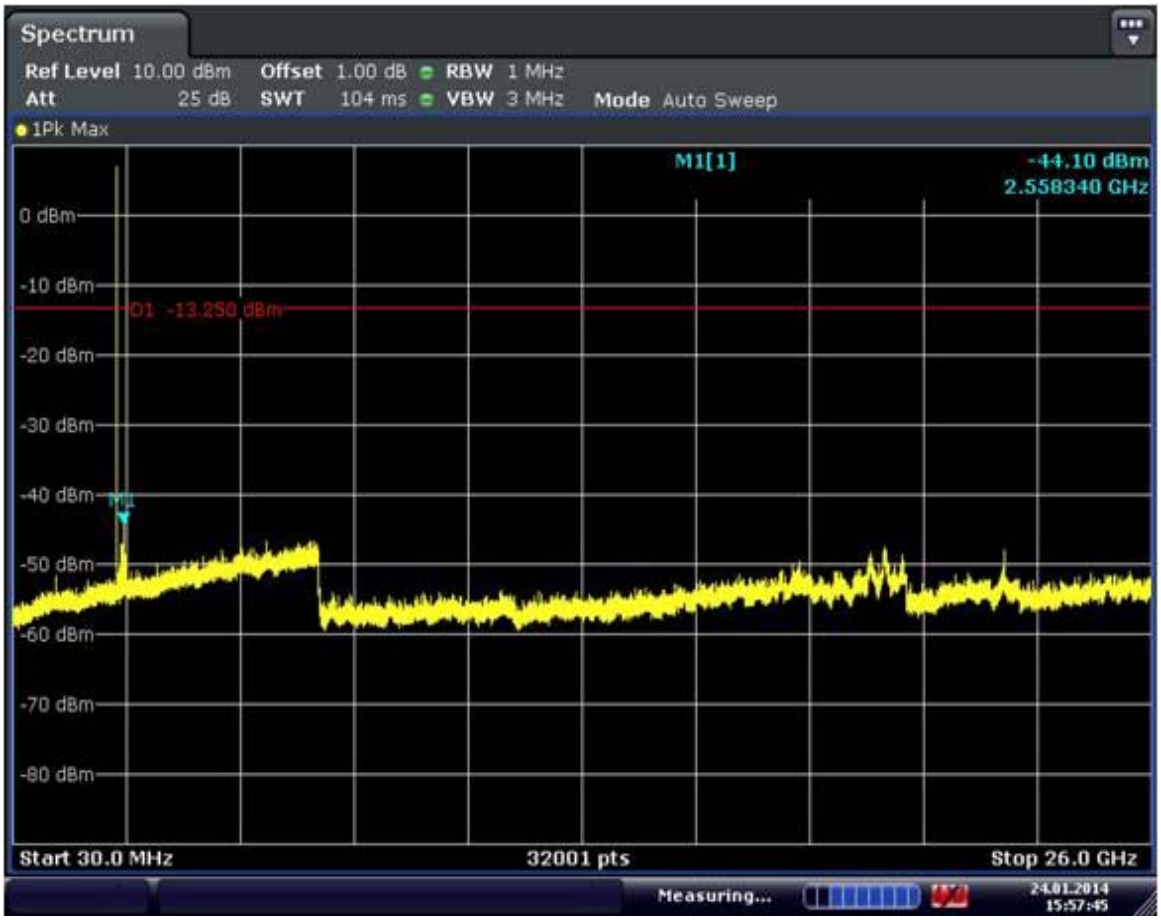


CH78

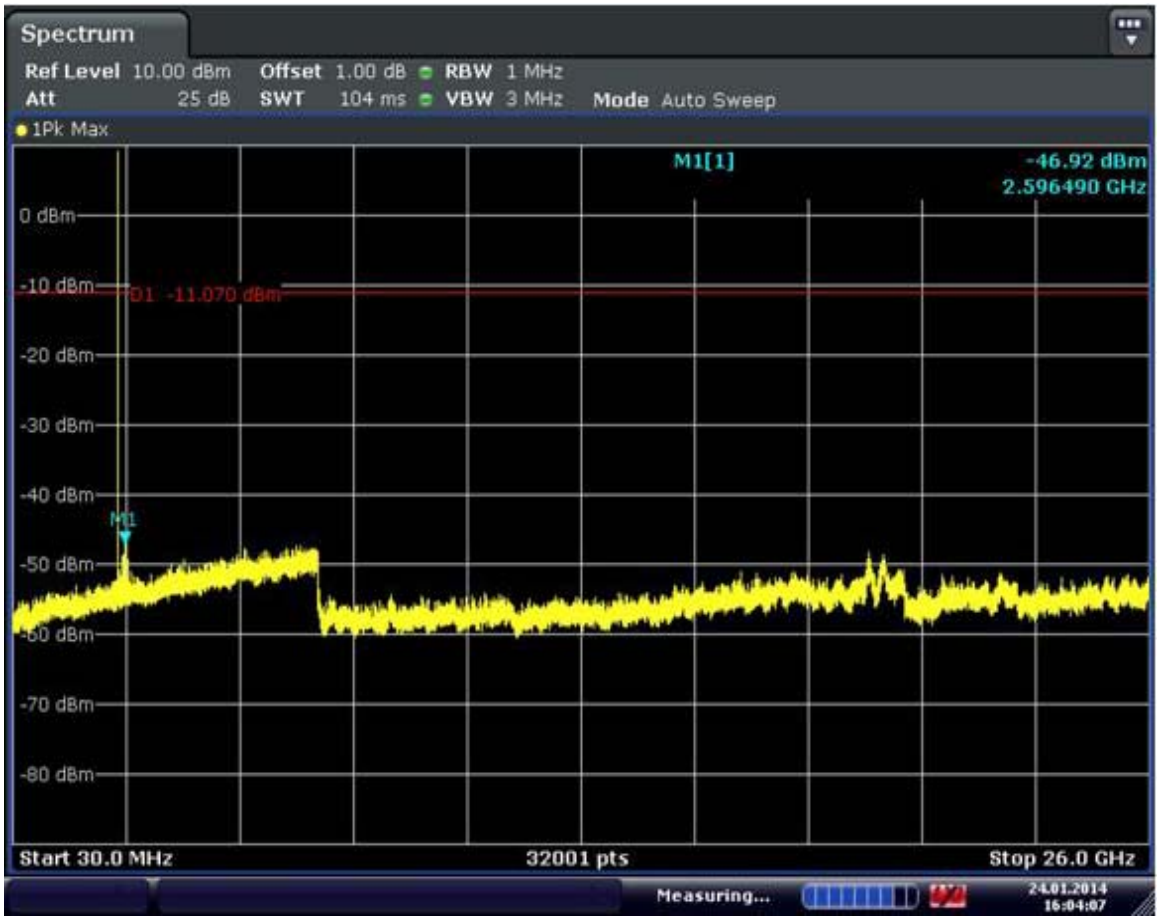


GFSK

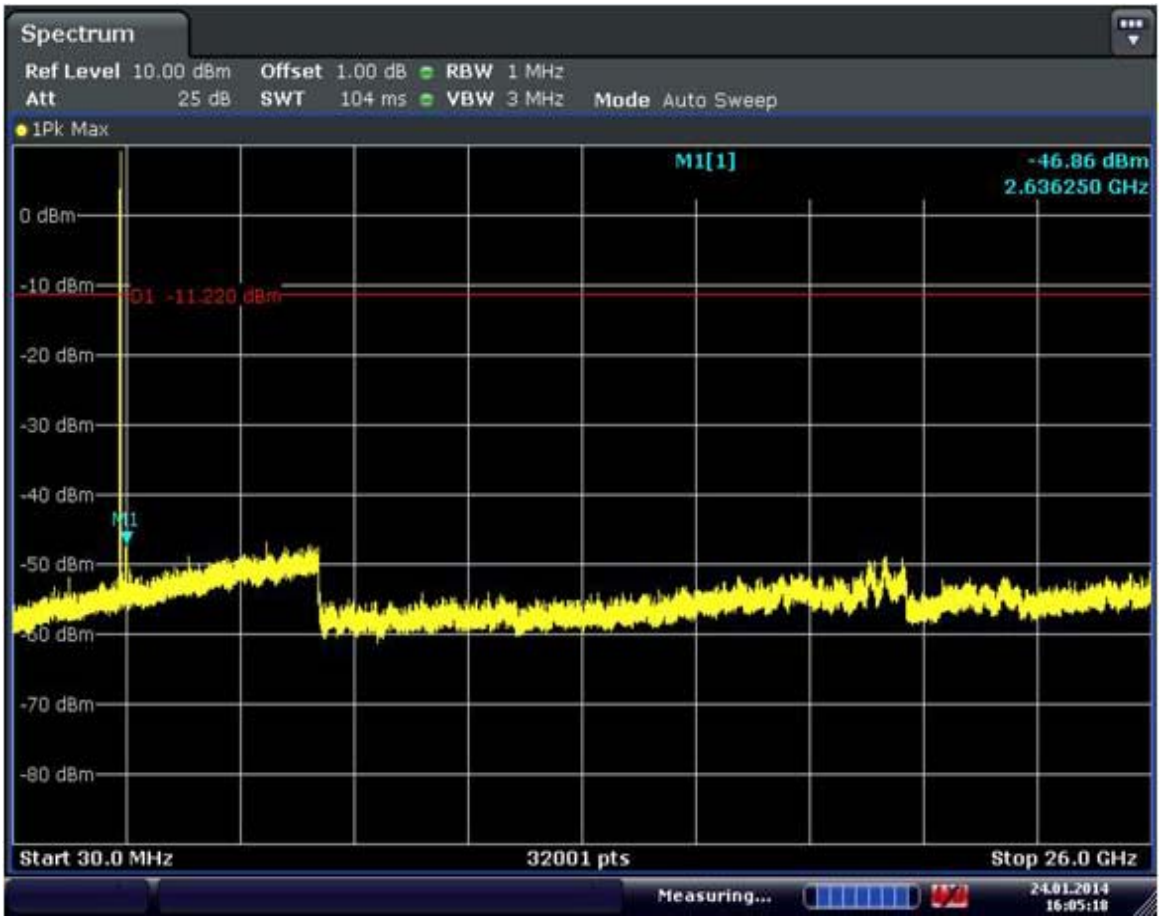
CH 0


Spectrum
Ref Level 10.00 dBm Offset 1.00 dB RBW 1 MHz
Att 25 dB SWT 104 ms VBW 3 MHz Mode Auto Sweep
1Pk Max
M1[1] -44.10 dBm
2.558340 GHz
0 dBm
-10 dBm
D1 -13.250 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
Start 30.0 MHz
32001 pts
Stop 26.0 GHz
Measuring...
24.01.2014
15:57:45

CH 39

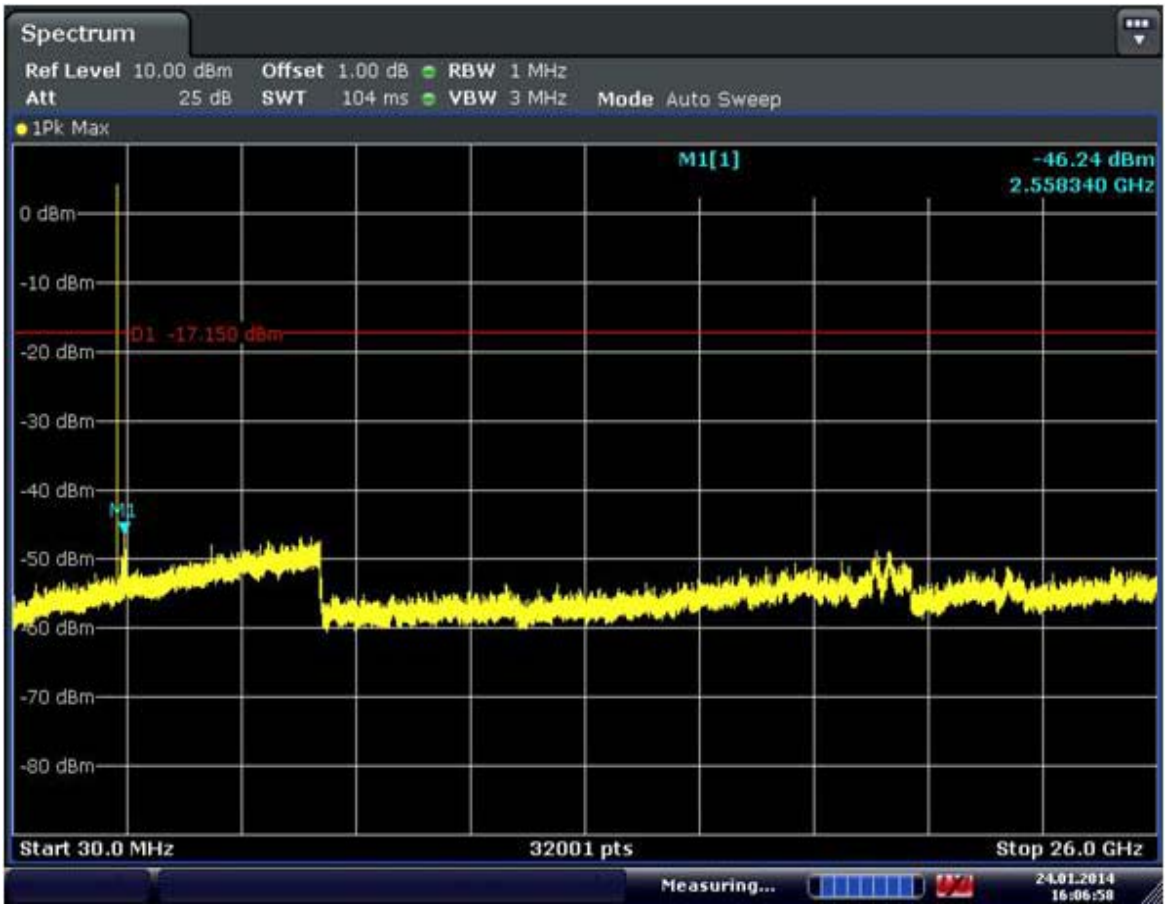

Spectrum
Ref Level 10.00 dBm Offset 1.00 dB RBW 1 MHz
Att 25 dB SWT 104 ms VBW 3 MHz Mode Auto Sweep
1Pk Max
M1[1] -46.92 dBm
2.596490 GHz
0 dBm
-10 dBm
D1 -11.070 dBm
-20 dBm
-30 dBm
-40 dBm
M1
-50 dBm
-60 dBm
-70 dBm
-80 dBm
Start 30.0 MHz
32001 pts
Stop 26.0 GHz
Measuring...
24.01.2014
16:04:07

CH 78

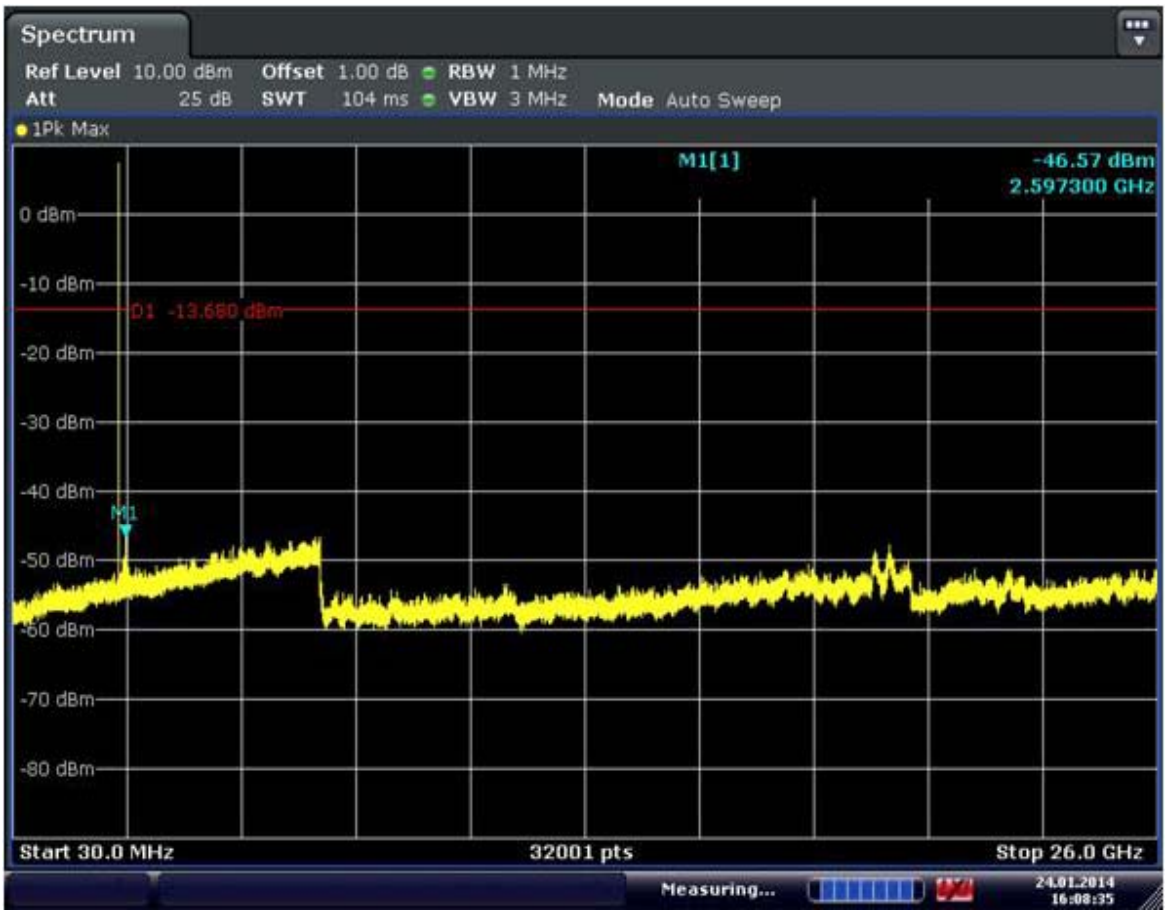

Spectrum
Ref Level 10.00 dBm
Offset 1.00 dB
RBW 1 MHz
Att 25 dB
SWT 104 ms
VBW 3 MHz
Mode Auto Sweep
1Pk Max
M1[1]
-46.86 dBm
2.636250 GHz
0 dBm
-10 dBm
D1 -11.220 dBm
-20 dBm
-30 dBm
-40 dBm
M1
-50 dBm
-60 dBm
-70 dBm
-80 dBm
Start 30.0 MHz
32001 pts
Stop 26.0 GHz
Measuring...
24.01.2014
16:05:18

8DPSK

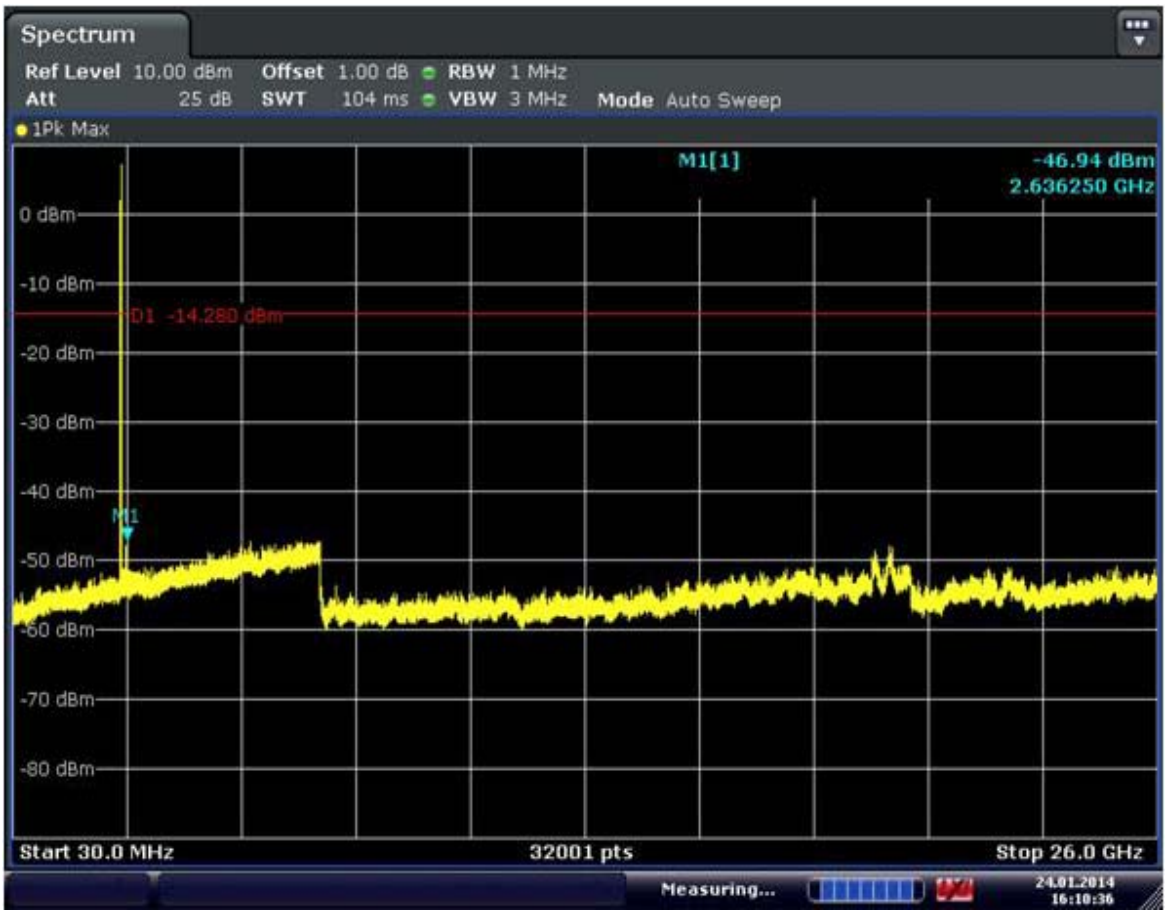
CH 0


Spectrum
Ref Level 10.00 dBm
Offset 1.00 dB
RBW 1 MHz
Att 25 dB
SWT 104 ms
VBW 3 MHz
Mode Auto Sweep
1Pk Max
M1[1]
-46.24 dBm
2.558340 GHz
0 dBm
-10 dBm
D1 -17.150 dBm
-20 dBm
-30 dBm
-40 dBm
M1
-50 dBm
-60 dBm
-70 dBm
-80 dBm
Start 30.0 MHz
32001 pts
Stop 26.0 GHz
Measuring...
24.01.2014
16:06:58

CH 39


Spectrum
Ref Level 10.00 dBm
Offset 1.00 dB
RBW 1 MHz
Att 25 dB
SWT 104 ms
VBW 3 MHz
Mode Auto Sweep
1Pk Max
M1[1]
-46.57 dBm
2.597300 GHz
0 dBm
-10 dBm
D1 -13.680 dBm
-20 dBm
-30 dBm
-40 dBm
M1
-50 dBm
-60 dBm
-70 dBm
-80 dBm
Start 30.0 MHz
32001 pts
Stop 26.0 GHz
Measuring...
24.01.2014
16:08:35

CH 78


Spectrum
Ref Level 10.00 dBm
Offset 1.00 dB
RBW 1 MHz
Att 25 dB
SWT 104 ms
VBW 3 MHz
Mode Auto Sweep
1Pk Max
M1[1]
-46.94 dBm
2.636250 GHz
0 dBm
-10 dBm
D1 -14.280 dBm
-20 dBm
-30 dBm
-40 dBm
M1
-50 dBm
-60 dBm
-70 dBm
-80 dBm
Start 30.0 MHz
32001 pts
Stop 26.0 GHz
Measuring...
24.01.2014
16:10:36

10. Measurement of radiated disturbance

Above 30 MHz Electric Field strength was measured in accordance with FCC PART 15.205, 15.209 & IC RSS-210 (A8.5). The test setup was made according to ANSI C 63.4 (2009) & DA 00-705 Semi-anechoic chamber, which allows a 3 m distance measurement. The EUT was placed in the center of styrofoam. turntable. The height of this table was 0.8 m. The measurement was conducted with both horizontal and vertical antenna polarization. The turntable has fully rotated. For further description of the configuration refer to the picture of the test setup.

10.1 Measurement equipments

Equipment Name	Type	Manufacturer	Serial No.	Next Calibration date
TEST Receiver	ESCI7	ROHDE & SCHWARZ	100916	23-Jan-15
Logbicon Antenna	VULB 9168	SCHWARZBECK	237	13-Jan-15
Turn Table	DT3000-2t	Innco System GmbH	N/A	-
Antenna Mast	MA4000-EP	Innco System GmbH	N/A	-
PREAMPLIFIER	8449B	AGILENT	3008A00595	13-Jan-15
Horn Antenna	BBHA9120D	SCHWARZBECK	469	11-Nov-14
Test Receiver	ESPI7	ROHDE & SCHWARZ	100185	13-Jan-15
Spectrum Analyzer	R3273	ADVANTEST	110600592	13-Jan-15
Turn Table	DT1500-S	Innco System GmbH	N/A	-
Antenna Mast	MA4000-EP	Innco System GmbH	N/A	-
Pyramidal Horn Antenna	3160-09-01	EST-LINDGREN	102642	14-Nov-14
Antenna Master & Turn table controller	C02000-P	Innco System GmbH	CO2000/642 /28051111/L	-
Bluetooth Tester	TC-3000A	TESCOM	3000A570224	13-Jan-15

10.2 Environmental Condition

Below 1 GHz -Test Place : 10 m Semi-anechoic chamber

BT Basic Rate Mode
Temperature (°C) : 21.5 ℃
Humidity (% R.H.) : 53.7 % R.H.

BT EDR Mode
Temperature (°C) : 20.5 ℃
Humidity (% R.H.) : 49.5 % R.H.

Above 1 GHz-Test Place : 3 m Semi-anechoic chamber

BT Basic Rate Mode
Temperature (°C) : 23.5 ℃
Humidity (% R.H.) : 52.9 % R.H.

BT EDR Mode
Temperature (°C) : 20.5 ℃
Humidity (% R.H.) : 55.4 % R.H.

10.3 Test Data for Bluetooth (Basic Rate)

Test Date : 3-Feb-14 Measurement Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Position (V/H)	Height (m)	Correction Factor		Result Value		
				Ant Factor (dB)	Cable (dB)	Limit (dBμV/m)	Result (dBμV/m)	Margin (dB)
63.90	9.58	V	1.0	11.87	1.32	40.00	22.77	17.23
72.00	11.71	V	1.0	10.85	1.40	40.00	23.96	16.04
86.10	13.61	V	1.0	8.31	1.55	40.00	23.47	16.53
144.00	5.52	H	2.5	12.34	1.95	43.50	19.81	23.69
214.90	9.03	V	1.0	10.16	2.32	43.50	21.51	21.99
400.00	5.57	H	1.7	15.81	3.14	46.00	24.52	21.48
644.80	4.98	H	1.2	20.49	3.97	46.00	29.44	16.56
750.50	4.90	V	1.0	21.87	4.29	46.00	31.06	14.94
893.90	4.78	H	1.0	23.53	4.69	46.00	33.01	12.99
931.40	4.13	H	1.0	23.92	4.78	46.00	32.83	13.17

Remark	H : Horizontal, V : Vertical Bluetooth (Basic Rate , 39 CH , 2441 MHz) *Checked in all 3 axis and the maximum measured data were reported. *CL = Cable Loss(In case of below1 000 MHz) *The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection at frequency below 1 GHz. *Result Value = Reading + Ant Factor + Cable loss *Margin= Limit - Result

10.3-1 Test Data for Bluetooth(Basic Rate)

Test Date : 3-Feb-14 Measurement Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Position (V/H)	Height (m)	Correction Factor		Duty Cycle Correction (dB)	Result Value		
				Ant Factor (dB)	Cable (dB)		Limit (dBμV/m)	Result (dBμV/m)	Margin (dB)
PEAK(RBW:1 MHz VBW:3 MHz)									
2363.00	27.11	H	1.2	27.44	5.60	0.00	74.00	60.15	13.85
2327.60	27.20	V	1.3	27.36	5.60	0.00	74.00	60.16	13.84
2390.00	25.29	H	1.2	27.51	5.60	0.00	74.00	58.40	15.60
2390.00	25.30	V	1.3	27.51	5.60	0.00	74.00	58.41	15.59
4804.00	52.87	H	1.1	31.36	-24.66	0.00	74.00	59.57	14.43
4804.00	50.55	V	1.4	31.36	-24.66	0.00	74.00	57.25	16.75
Average (RBW:1 MHz VBW:1 kHz)									
2363.00	13.89	H	1.2	27.44	5.60	-30.60	54.00	16.33	37.67
2327.60	13.86	V	1.3	27.36	5.60	-30.60	54.00	16.22	37.78
2390.00	13.69	H	1.2	27.51	5.60	-30.60	54.00	16.20	37.80
2390.00	13.87	V	1.3	27.51	5.60	-30.60	54.00	16.38	37.62
4804.00	46.30	H	1.1	31.36	-24.66	-30.60	54.00	22.40	31.60
4804.00	44.12	V	1.4	31.36	-24.66	-30.60	54.00	20.22	33.78

Remark	H : Horizontal, V : Vertical TEST MODE : Bluetooth Basic Rate-CH0(2402 MHz) *The TX signal wasn't detected from 3th harmonics. *Checked in all 3 axis and the maximum measured data were reported. *Result Value = Reading + Ant Factor + Cable loss - Amplifier Gain + Duty Cycle Correction Factor *Margin= Limit - Result *The resolution bandwidth and video bandwidth of spectrum analyzer is 1 MHz and 1 kHz for average detection at frequency above 1 GHz. FYI : Duty Cycle Correction Factor (79 channel hopping) a. Worst Case Dwell Time = 2.95 ms b. Duty Cycle Correction = 20log (Worst Case Dwell Time/ 100ms) dB = - 30.60 dB

10.3-2 Test Data for Bluetooth(Basic Rate)

Test Date : 3-Feb-14 Measurement Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Position (V/H)	Height (m)	Correction Factor		Duty Cycle Correction (dB)	Result Value		
				Ant Factor (dB)	Cable (dB)		Limit (dBμV/m)	Result (dBμV/m)	Margin (dB)
PEAK(RBW:1 MHz VBW:3 MHz)									
4882.00	54.59	H	1.4	31.49	-24.27	0.00	74.00	61.81	12.19
4882.00	53.21	V	1.2	31.49	-24.27	0.00	74.00	60.43	13.57
Average (RBW:1 MHz VBW:1 kHz)									
4882.00	50.18	H	1.4	31.49	-24.27	-30.60	54.00	26.80	27.20
4882.00	48.86	V	1.2	31.49	-24.27	-30.60	54.00	25.48	28.52

Remark	H : Horizontal, V : Vertical TEST MODE : Bluetooth Basic Rate-CH39(2441 MHz) *The TX signal wasn't detected from 3th harmonics. *Checked in all 3 axis and the maximum measured data were reported. *Result Value = Reading + Ant Factor + Cable loss - Amplifier Gain + Duty Cycle Correction Factor *Margin= Limit - Result *The resolution bandwidth and video bandwidth of spectrum analyzer is 1 MHz and 1 kHz for average detection at frequency above 1 GHz. FYI : Duty Cycle Correction Factor (79 channel hopping) a. Worst Case Dwell Time = 2.95 ms b. Duty Cycle Correction = 20log (Worst Case Dwell Time/ 100ms) dB = - 30.60 dB

10.3-3 Test Data for Bluetooth(Basic Rate)

Test Date : 3-Feb-14 Measurement Distance : 3 m

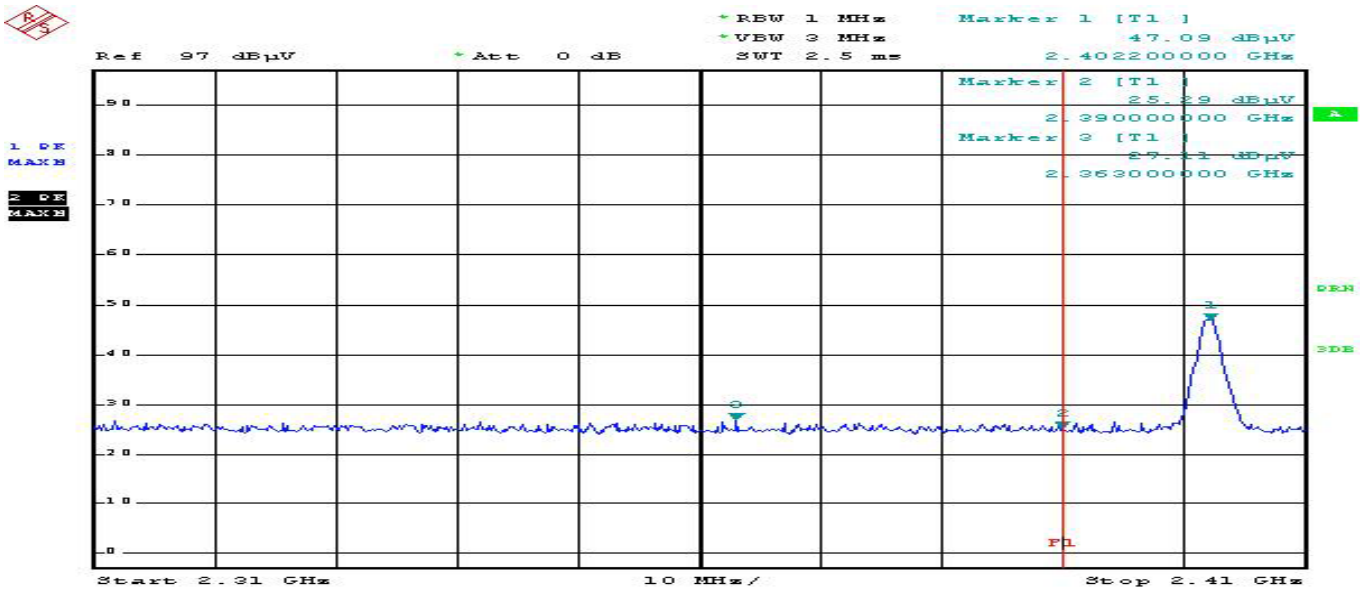
Frequency (MHz)	Reading (dBμV)	Position (V/H)	Height (m)	Correction Factor		Duty Cycle Correction (dB)	Result Value		
				Ant Factor (dB)	Cable (dB)		Limit (dBμV/m)	Result (dBμV/m)	Margin (dB)
PEAK(RBW:1 MHz VBW:3 MHz)									
2483.50	25.21	H	1.2	27.74	5.60	0.00	74.00	52.95	21.05
2483.50	24.94	V	1.1	27.74	5.60	0.00	74.00	58.28	15.72
2491.85	26.65	H	1.3	27.76	5.60	0.00	74.00	60.01	13.99
2488.25	27.32	V	1.1	27.75	5.60	0.00	74.00	60.67	13.33
4960.00	54.54	H	1.2	31.62	-23.93	0.00	74.00	62.23	11.77
4960.00	51.55	V	1.1	31.62	-23.93	0.00	74.00	59.24	14.76
Average (RBW:1 MHz VBW:1 kHz)									
2483.50	13.67	H	1.2	27.74	5.60	-30.60	54.00	16.41	37.59
2483.50	13.61	V	1.1	27.74	5.60	-30.60	54.00	16.35	37.65
2491.85	13.60	H	1.3	27.76	5.60	-30.60	54.00	16.36	37.64
2488.25	13.65	V	1.1	27.75	5.60	-30.60	54.00	16.40	37.60
4960.00	49.95	H	1.2	31.62	-23.93	-30.60	54.00	27.04	26.96
4960.00	45.92	V	1.1	31.62	-23.93	-30.60	54.00	23.01	30.99

Remark	H : Horizontal, V : Vertical TEST MODE : Bluetooth Basic rate-CH78(2480 MHz) *The TX signal wasn't detected from 3th harmonics. *Checked in all 3 axis and the maximum measured data were reported. *Result Value = Reading + Ant Factor + Cable loss - Amplifier Gain + Duty Cycle Correction Factor *Margin= Limit - Result *The resolution bandwidth and video bandwidth of spectrum analyzer is 1 MHz and 1 kHz for average detection at frequency above 1 GHz. FYI : Duty Cycle Correction Factor (79 channel hopping) a. Worst Case Dwell Time = 2.95 ms b. Duty Cycle Correction = 20log (Worst Case Dwell Time/ 100ms) dB = - 30.60 dB

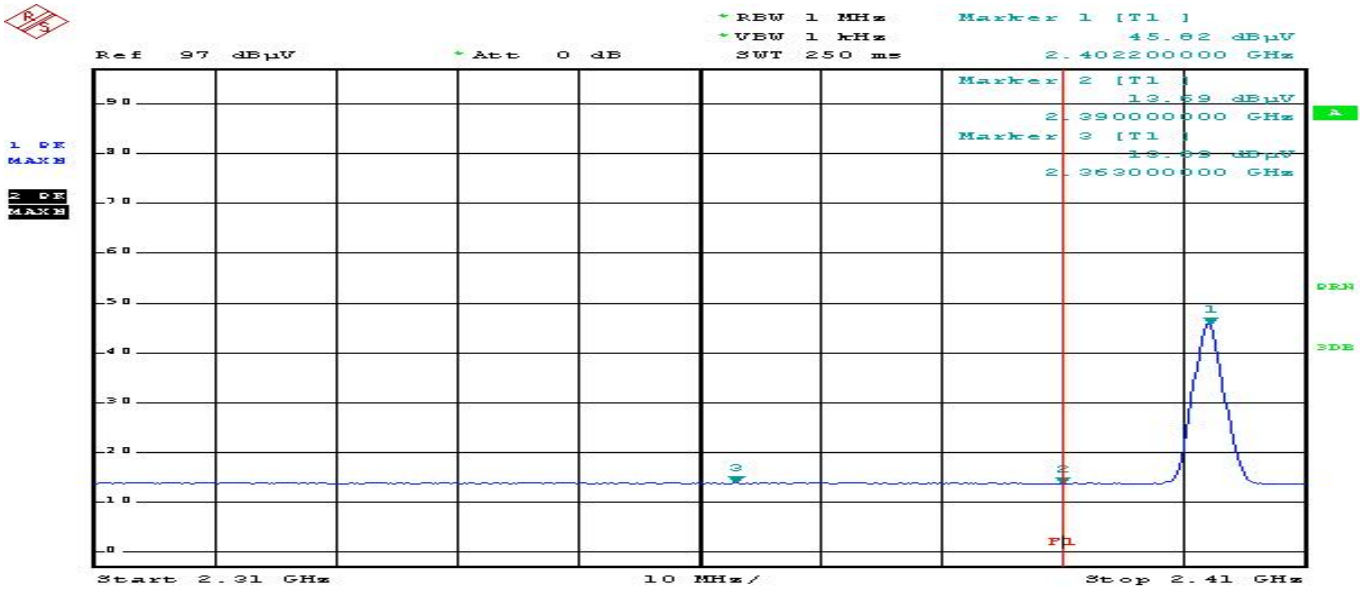
10.4 Restricted Band Edges for BT(Basic Rate)

Band Edges(CH Low)

Detector mode:Peak Polarity:Horizontal

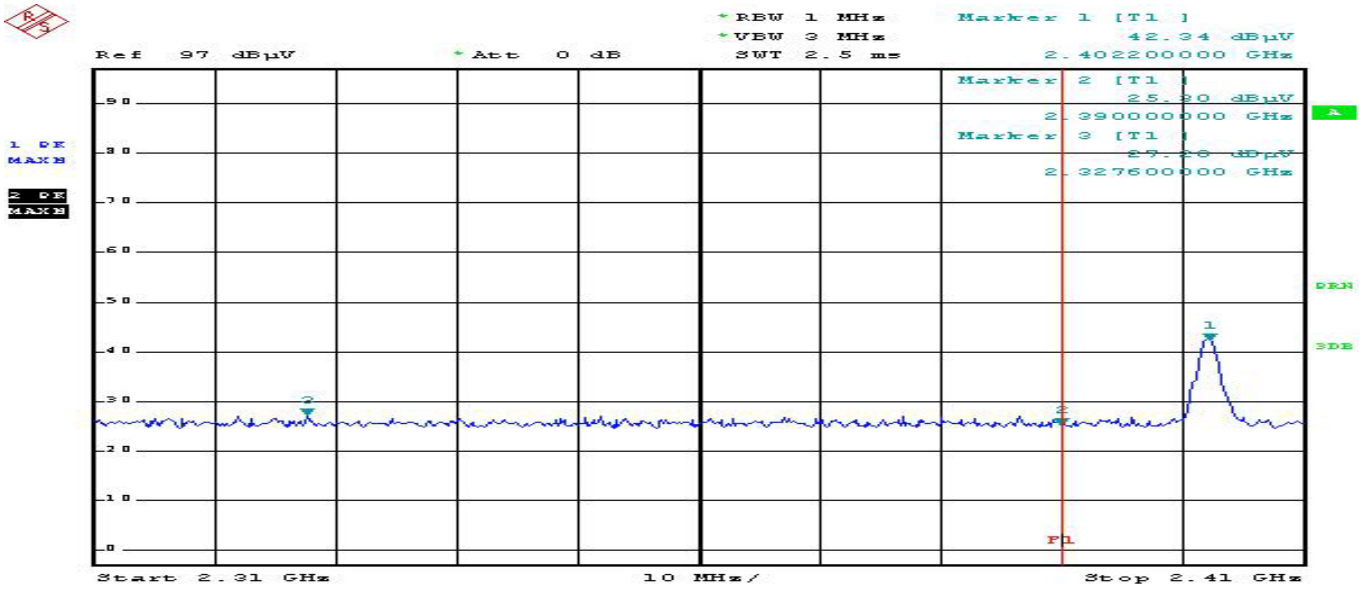


Detector mode:Average Polarity:Horizontal

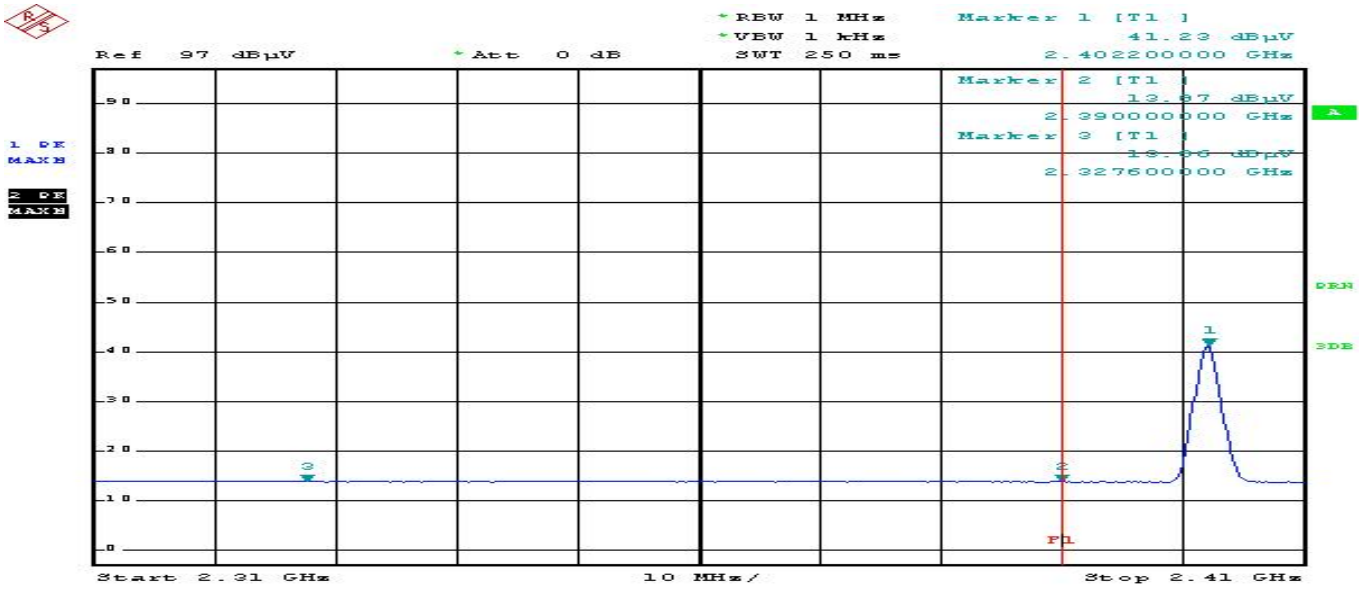


Band Edges(CH Low)

Detector mode:Peak Polarity:Vertical

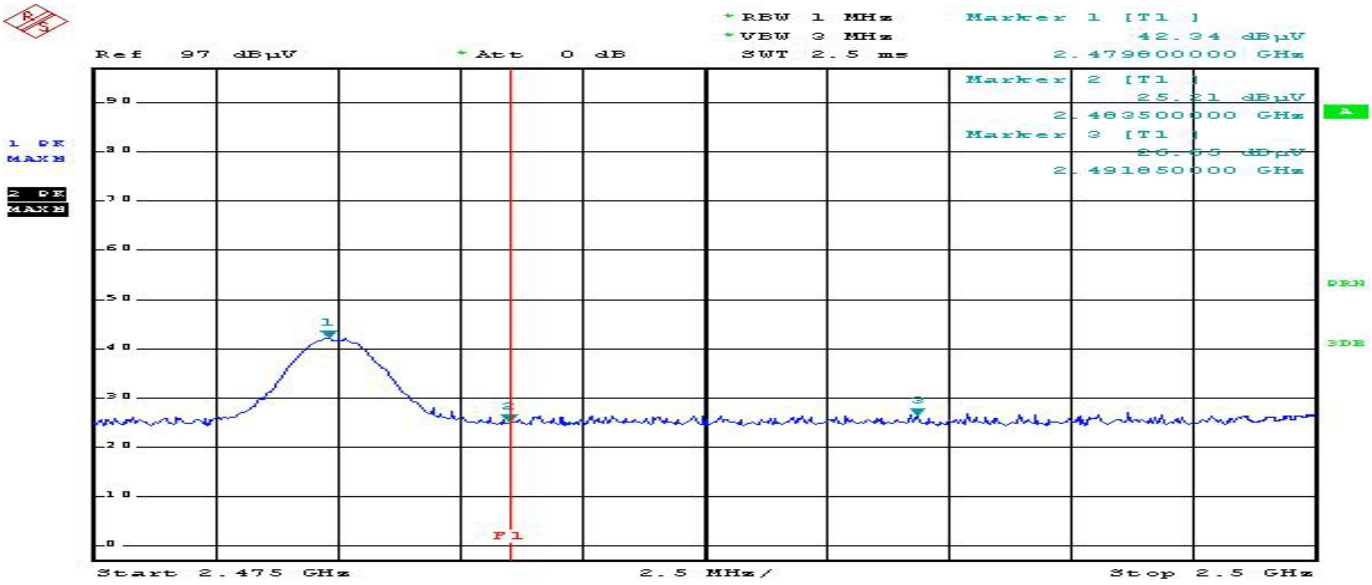


Detector mode:Average Polarity:Vertical

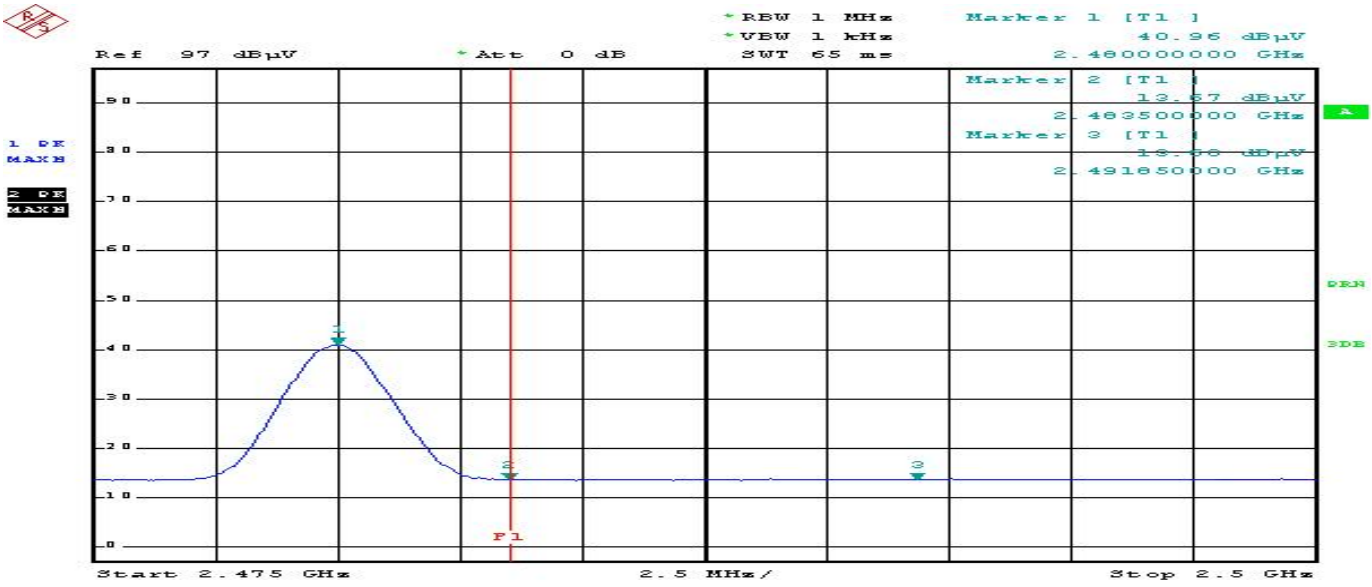


Band Edges(CH High)

Detector mode:Peak Polarity:Horizontal

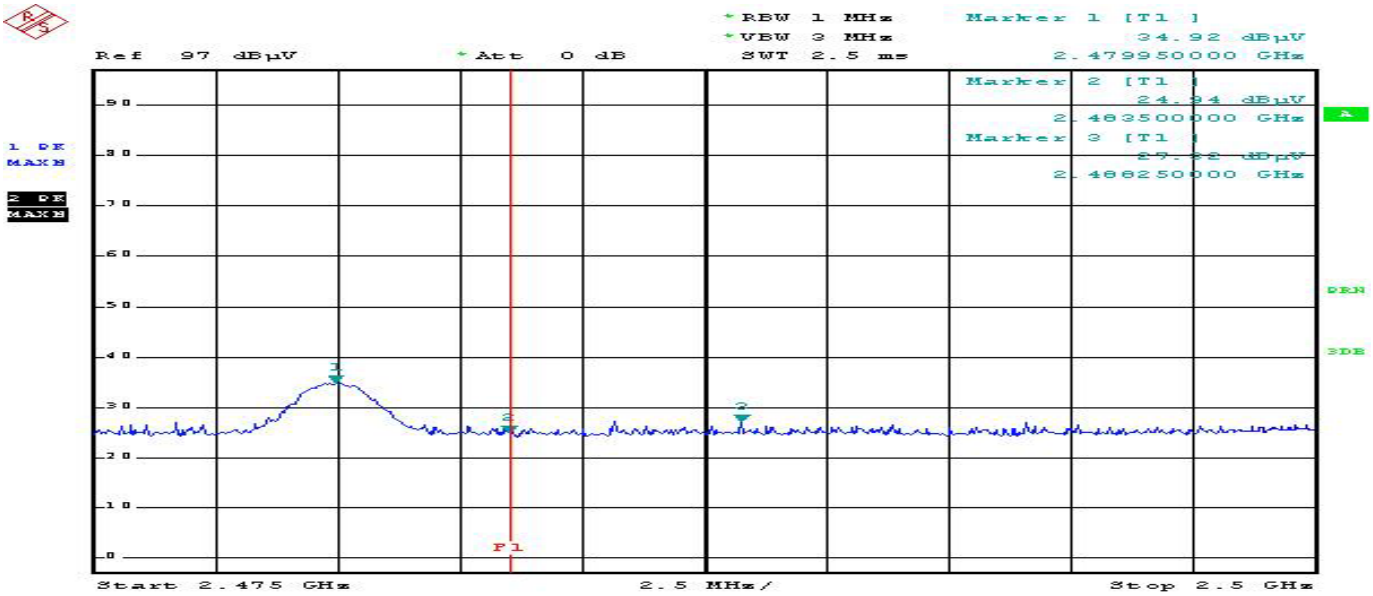


Detector mode:Average Polarity:Horizontal

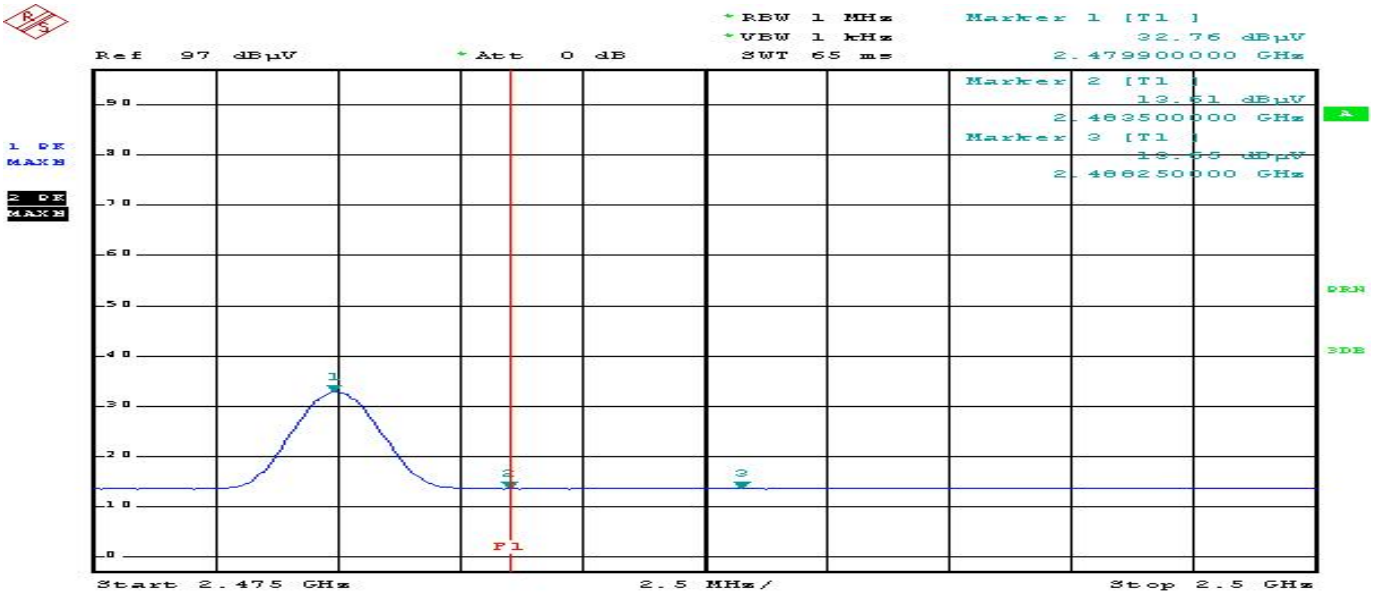


Band Edges(CH High)

Detector mode:Peak Polarity:Vertical



Detector mode:Average Polarity:Vertical



10.5 Test Data for Bluetooth (EDR)

Test Date : 4-Feb-14 Measurement Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Position (V/H)	Height (m)	Correction Factor		Result Value		
				Ant Factor (dB)	Cable (dB)	Limit (dBμV/m)	Result (dBμV/m)	Margin (dB)
69.10	11.59	V	1.0	11.32	1.36	40.00	24.27	15.73
74.00	9.29	V	1.0	10.48	1.42	40.00	21.19	18.81
87.40	12.87	V	1.0	8.09	1.56	40.00	22.52	17.48
144.80	7.22	V	1.0	12.36	1.95	43.50	21.54	21.96
149.00	11.94	V	1.0	12.49	1.97	43.50	26.40	17.10
635.10	4.96	H	1.4	20.39	3.94	46.00	29.29	16.71
771.20	4.52	V	1.0	22.21	4.34	46.00	31.07	14.93
850.00	4.70	H	1.0	23.13	4.57	46.00	32.39	13.61
936.10	4.00	H	1.0	23.97	4.79	46.00	32.76	13.24

Remark	H : Horizontal, V : Vertical Bluetooth (EDR , 39 CH , 2441 MHz) *Checked in all 3 axis and the maximum measured data were reported. *CL = Cable Loss(In case of below1 000 MHz) *The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection at frequency below 1 GHz. *Result Value = Reading + Ant Factor + Cable loss *Margin= Limit - Result

10.5-1 Test Data for Bluetooth(EDR)

Test Date : 4-Feb-14 Measurement Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Position (V/H)	Height (m)	Correction Factor		Duty Cycle Correction (dB)	Result Value		
				Ant Factor (dB)	Cable (dB)		Limit (dBμV/m)	Result (dBμV/m)	Margin (dB)
PEAK(RBW:1 MHz VBW:3 MHz)									
2334.40	27.27	H	1.1	27.37	5.60	0.00	74.00	60.24	13.76
2368.00	27.04	V	1.3	27.46	5.60	0.00	74.00	60.10	13.90
2390.00	25.07	H	1.0	27.51	5.60	0.00	74.00	58.18	15.82
2390.00	25.19	V	1.2	27.51	5.60	0.00	74.00	58.30	15.70
4804.00	51.82	H	1.1	31.36	-24.66	0.00	74.00	58.52	15.48
4804.00	50.03	V	1.0	31.36	-24.66	0.00	74.00	56.73	17.27
Average (RBW:1 MHz VBW:1 kHz)									
2334.40	13.82	H	1.1	27.37	5.60	-30.54	54.00	16.25	37.75
2368.00	13.82	V	1.3	27.46	5.60	-30.54	54.00	16.34	37.66
2390.00	13.87	H	1.0	27.51	5.60	-30.54	54.00	16.44	37.56
2390.00	13.71	V	1.2	27.51	5.60	-30.54	54.00	16.28	37.72
4804.00	41.47	H	1.1	31.36	-24.66	-30.54	54.00	17.63	36.37
4804.00	37.94	V	1.0	31.36	-24.66	-30.54	54.00	14.10	39.90

Remark

H : Horizontal, V : Vertical TEST MODE : Bluetooth EDR-CH0(2402 MHz)

*The TX signal wasn't detected from 3th harmonics.
*Checked in all 3 axis and the maximum measured data were reported.
*Result Value = Reading + Ant Factor + Cable loss - Amplifier Gain + Duty Cycle Correction Factor
*Margin= Limit - Result
*The resolution bandwidth and video bandwidth of spectrum analyzer is 1 MHz and 1 kHz for average detection at frequency above 1 GHz.

FYI : Duty Cycle Correction Factor (79 channel hopping)
a. Worst Case Dwell Time = 2.97 ms
b. Duty Cycle Correction = 20log (Worst Case Dwell Time/ 100ms) dB = - 30.54 dB

10.5-2 Test Data for Bluetooth(EDR)

Test Date : 4-Feb-14 Measurement Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Position (V/H)	Height (m)	Correction Factor		Duty Cycle Correction (dB)	Result Value		
				Ant Factor (dB)	Cable (dB)		Limit (dBμV/m)	Result (dBμV/m)	Margin (dB)
PEAK(RBW:1 MHz VBW:3 MHz)									
4882.00	52.21	H	1.0	31.49	-24.27	0.00	74.00	59.43	14.57
4882.00	51.60	V	1.2	31.49	-24.27	0.00	74.00	58.82	15.18
Average(RBW:1 MHz VBW:1 kHz)									
4882.00	45.00	H	1.0	31.49	-24.27	-30.54	54.00	21.68	32.32
4882.00	43.16	V	1.2	31.49	-24.27	-30.54	54.00	19.84	34.16

Remark

H : Horizontal, V : Vertical TEST MODE : Bluetooth EDR-CH39(2441 MHz)

*The TX signal wasn't detected from 3th harmonics.
*Checked in all 3 axis and the maximum measured data were reported.
*Result Value = Reading + Ant Factor + Cable loss - Amplifier Gain + Duty Cycle Correction Factor
*Margin= Limit - Result
*The resolution bandwidth and video bandwidth of spectrum analyzer is 1 MHz and 1 kHz for average detection at frequency above 1 GHz.

FYI : Duty Cycle Correction Factor (79 channel hopping)

a. Worst Case Dwell Time = 2.97 ms
b. Duty Cycle Correction = 20log (Worst Case Dwell Time/ 100ms) dB = - 30.54 dB

10.5-3 Test Data for Bluetooth(EDR)

Test Date : 4-Feb-14 Measurement Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Position (V/H)	Height (m)	Correction Factor		Duty Cycle Correction (dB)	Result Value		
				Ant Factor (dB)	Cable (dB)		Limit (dBμV/m)	Result (dBμV/m)	Margin (dB)
PEAK(RBW:1 MHz VBW:3 MHz)									
2483.50	25.30	H	1.3	27.74	5.60	0.00	74.00	58.64	15.36
2483.50	24.79	V	1.2	27.74	5.60	0.00	74.00	58.13	15.87
2497.30	27.32	H	1.1	27.77	5.60	0.00	74.00	60.69	13.31
2488.00	26.69	V	1.2	27.75	5.60	0.00	74.00	60.04	13.96
4960.00	50.30	H	1.0	31.62	-23.93	0.00	74.00	57.99	16.01
4960.00	49.30	V	1.2	31.62	-23.93	0.00	74.00	56.99	17.01
Average (RBW:1 MHz VBW:1 kHz)									
2483.50	13.56	H	1.3	27.74	5.60	-30.54	54.00	16.36	37.64
2483.50	13.59	V	1.2	27.74	5.60	-30.54	54.00	16.39	37.61
2497.30	13.65	H	1.1	27.77	5.60	-30.54	54.00	16.48	37.52
2488.00	13.67	V	1.2	27.75	5.60	-30.54	54.00	16.48	37.52
4960.00	43.55	H	1.0	31.62	-23.93	-30.54	54.00	20.70	33.30
4960.00	40.17	V	1.2	31.62	-23.93	-30.54	54.00	17.32	36.68

Remark

H : Horizontal, V : Vertical TEST MODE : Bluetooth EDR-CH78(2480 MHz)

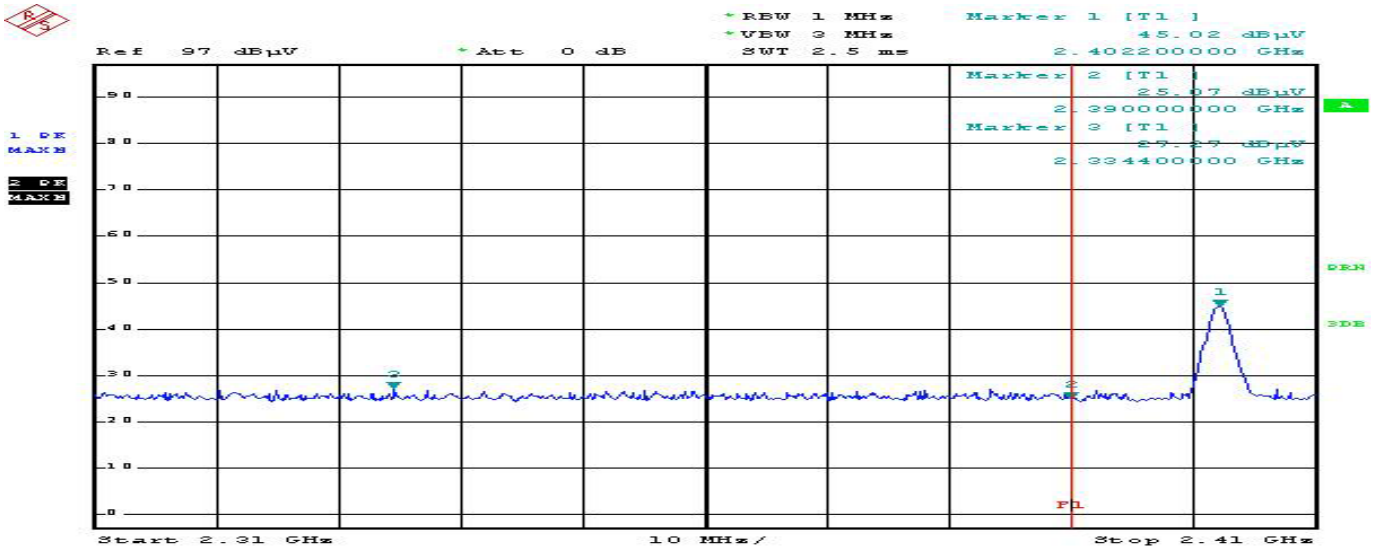
*The TX signal wasn't detected from 3th harmonics.
*Checked in all 3 axis and the maximum measured data were reported.
*Result Value = Reading + Ant Factor + Cable loss - Amplifier Gain + Duty Cycle Correction Factor
*Margin= Limit - Result
*The resolution bandwidth and video bandwidth of spectrum analyzer is 1 MHz and 1 kHz for average detection at frequency above 1 GHz.

FYI : Duty Cycle Correction Factor (79 channel hopping)
a. Worst Case Dwell Time = 2.97 ms
b. Duty Cycle Correction = 20log (Worst Case Dwell Time/ 100ms) dB = - 30.54 dB

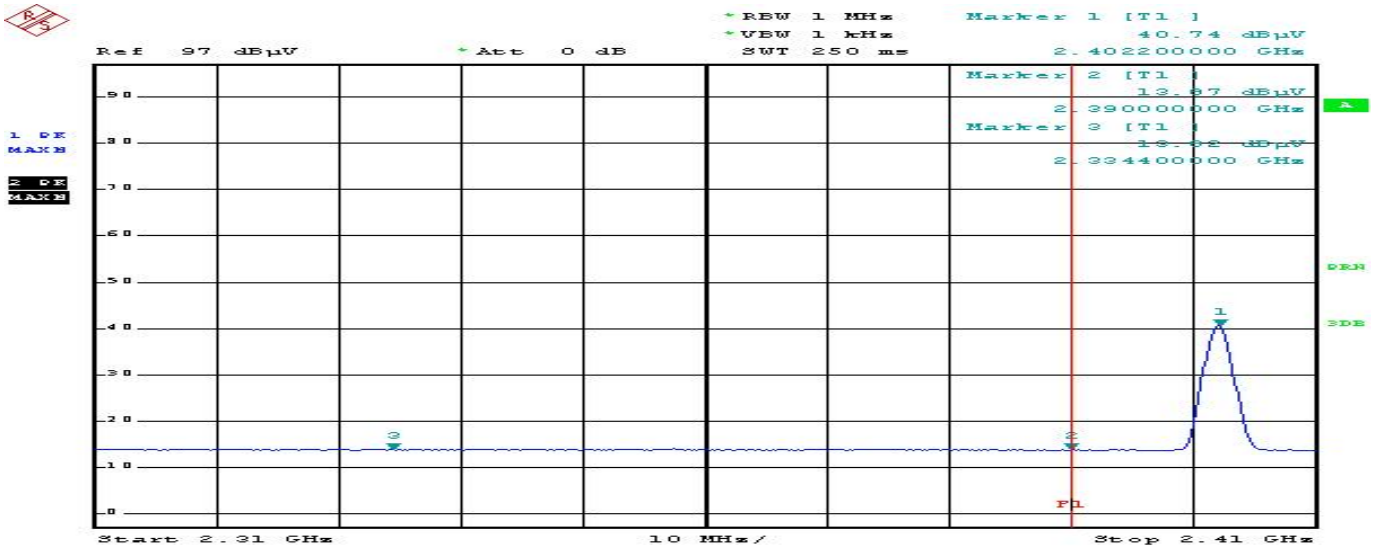
10.6 Restricted Band Edges for BT(EDR)

Band Edges(CH Low)

Detector mode:Peak Polarity:Horizontal

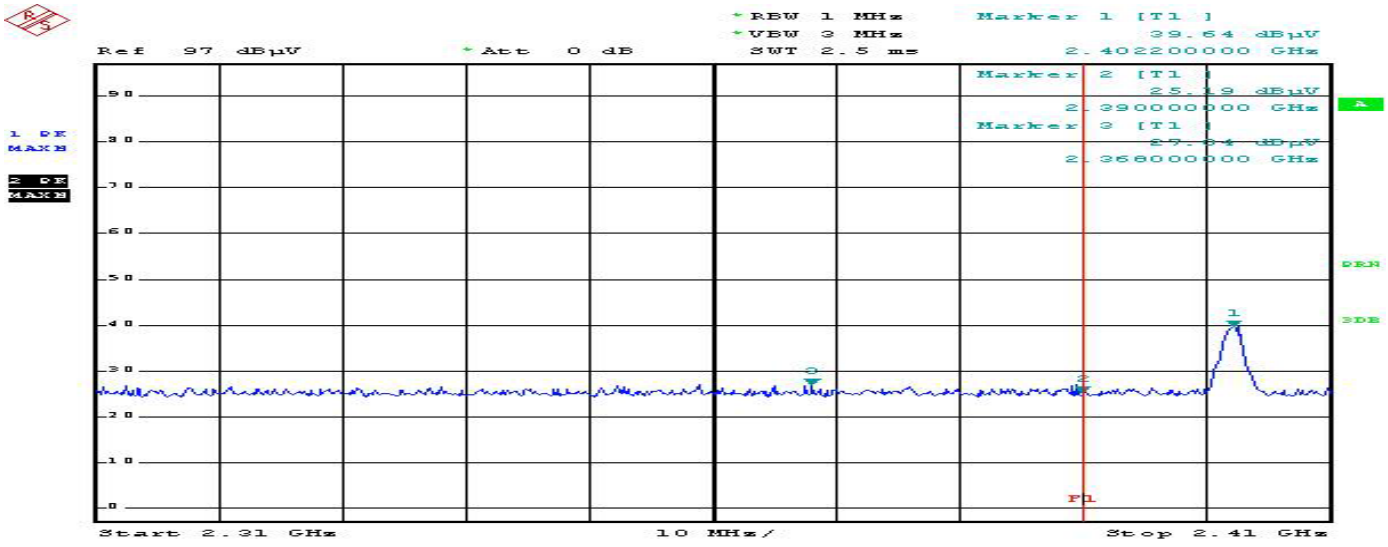


Detector mode:Average Polarity:Horizontal

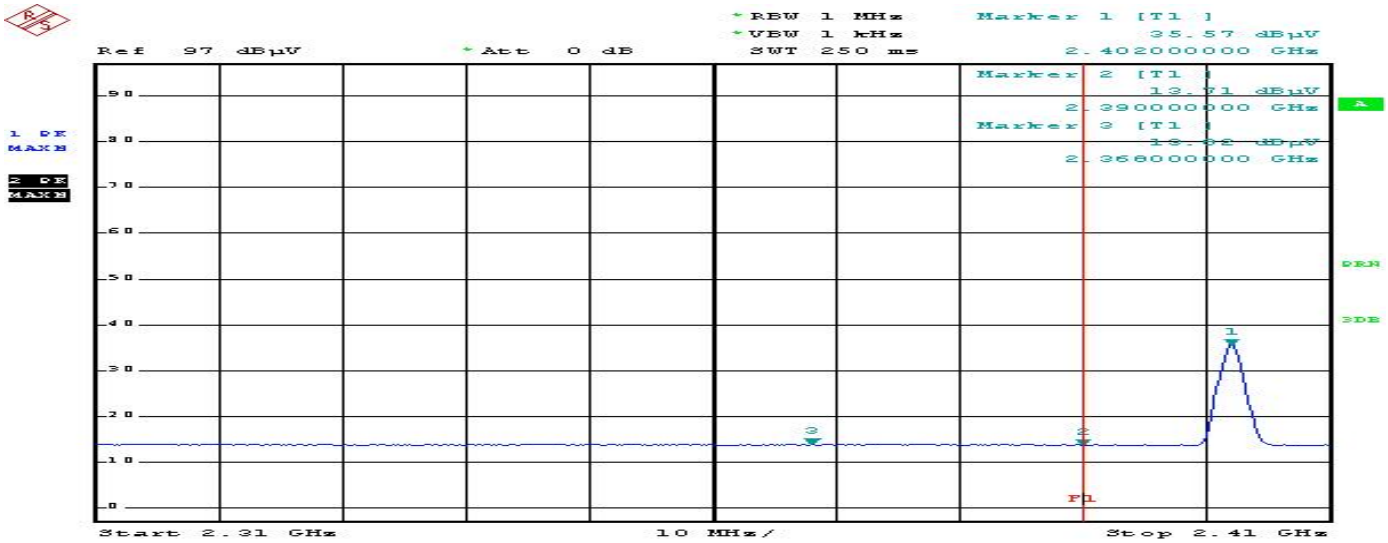


Band Edges(CH Low)

Detector mode:Peak Polarity:Vertical

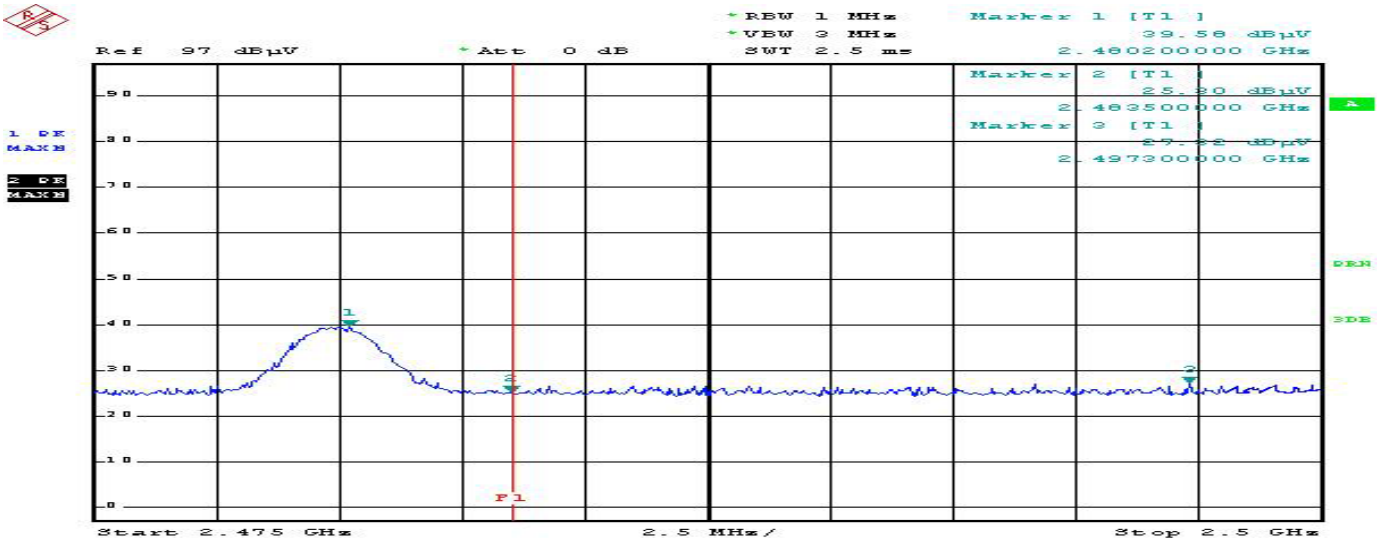


Detector mode:Average Polarity:Vertical

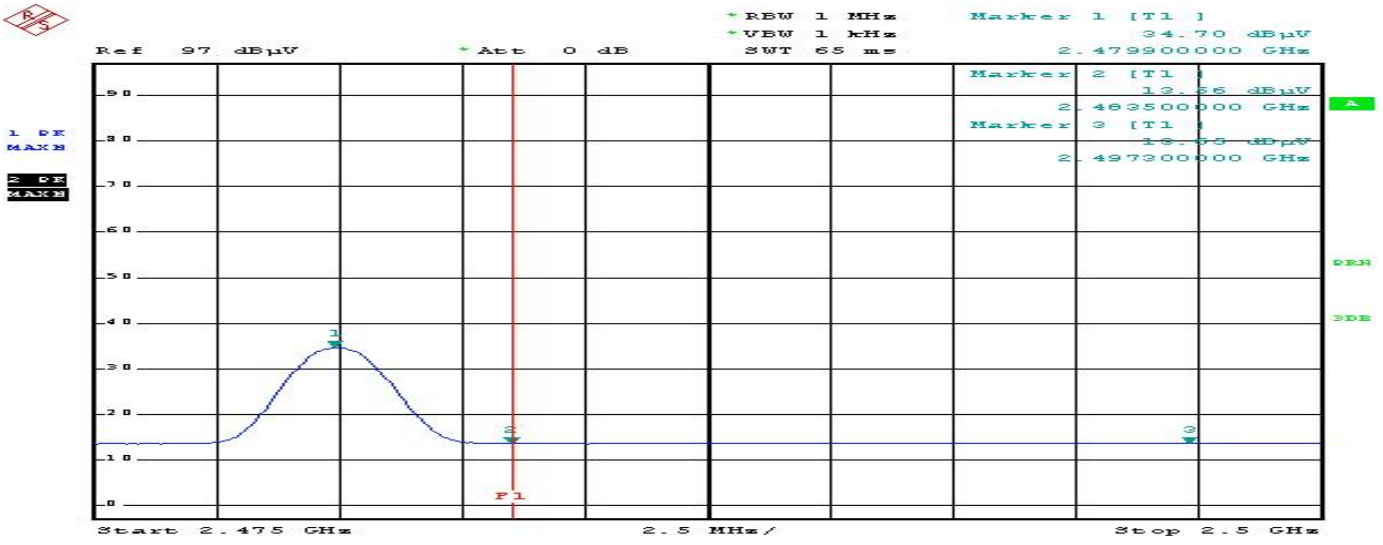


Band Edges(CH High)

Detector mode:Peak Polarity:Horizontal

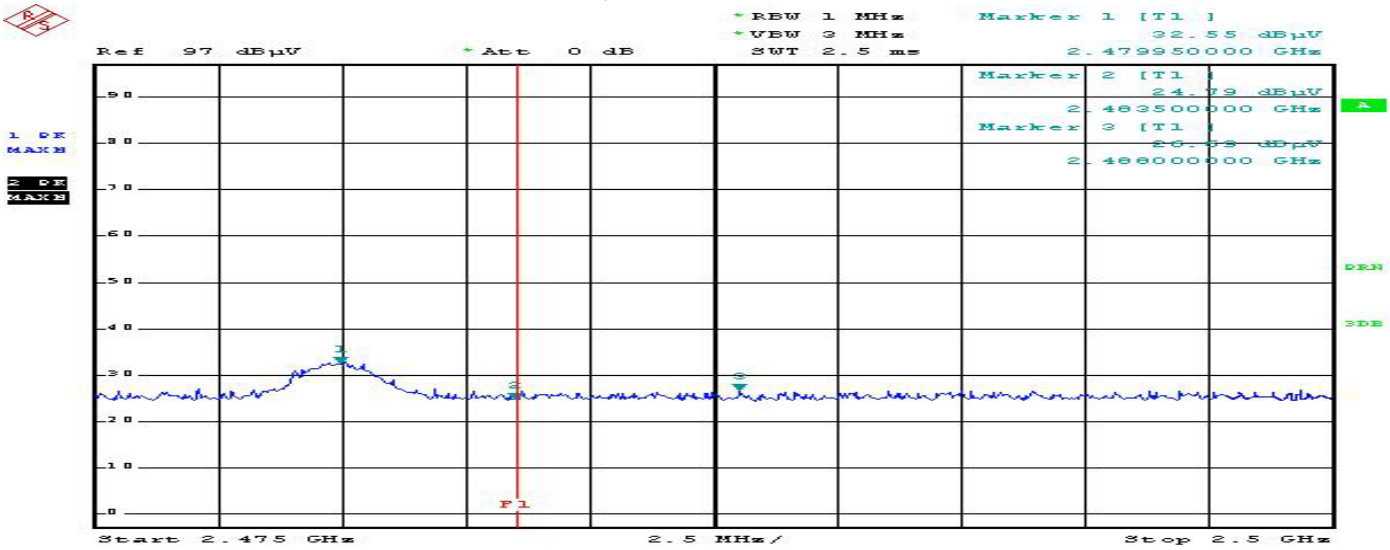


Detector mode:Average Polarity:Horizontal

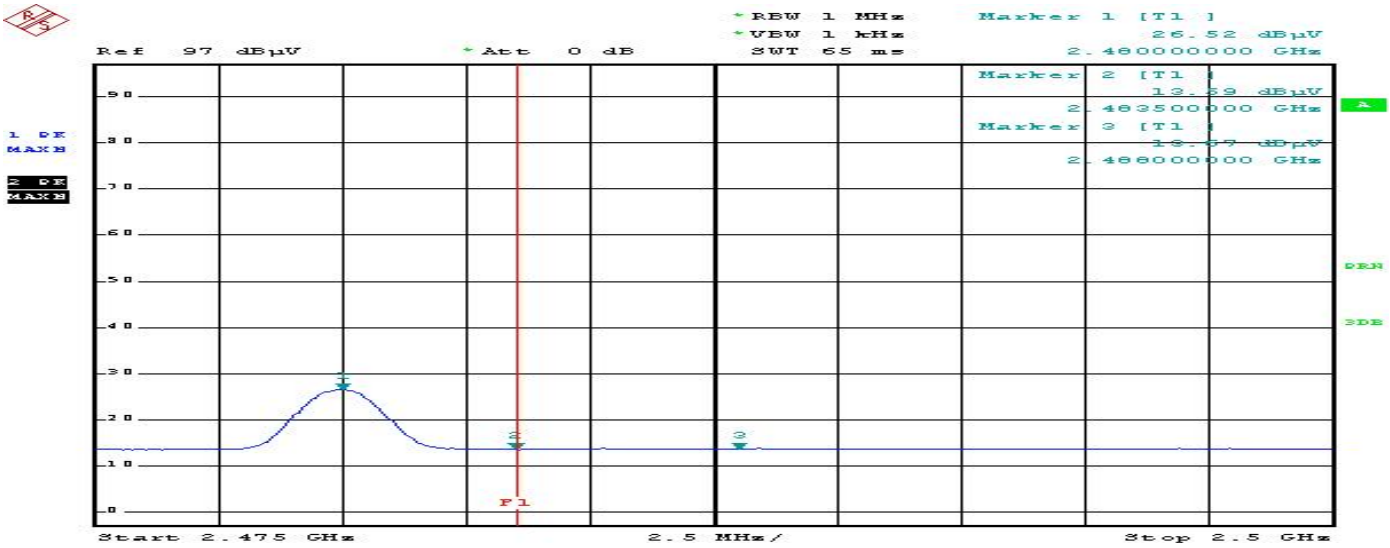


Band Edges(CH High)

Detector mode:Peak Polarity:Vertical



Detector mode:Average Polarity:Vertical



11. Measurement of conducted disturbance (N/A)

The continuous disturbance voltage of AC Mains in the frequency from 0.15 MHz to 30 MHz was measured in accordance to FCC PART 15.207 & IC RSS-Gen 7.2.2. The test setup was made according to ANSI C 63.4 (2009) in a shielded room. The EUT was placed on a non-conductive table at least 0.8 m above the ground plan. A grounded vertical reference plane was positioned in a distance of 0.4 m from the EUT. The distance from the EUT to other metal surfaces was at least 0.8 m. The EUT was only earthen by its power cord through the line impedance stabilizing network. The power cord has been bundled to a length of 1.0 m. The test receiver with Quasi Peak detector complies with CISPR 16.

11.1 Measurement equipments

Equipment Name	Type	Manufacturer	Serial No.	Next Calibration date
TEST Receiver	ESHS 30	Rohde & Schwarz	828765/002	13-Jan-15
LISN	ENV216	Rohde & Schwarz	101231	26-Aug-14
LISN	ESH3-Z5	Rohde & Schwarz	838979/010	13-Jan-15
Pulse Limiter	ESH3Z2	Rohde & Schwarz	NONE	13-Jan-15
Bluetooth Tester	TC-3000A	TESCOM	3000A570224	13-Jan-15

11.2 Environmental Condition

Test Place :

Temperature (°C) :

Humidity (% R.H.) :

11.3 Test Data for Bluetooth (Basic Rate)(N/A)

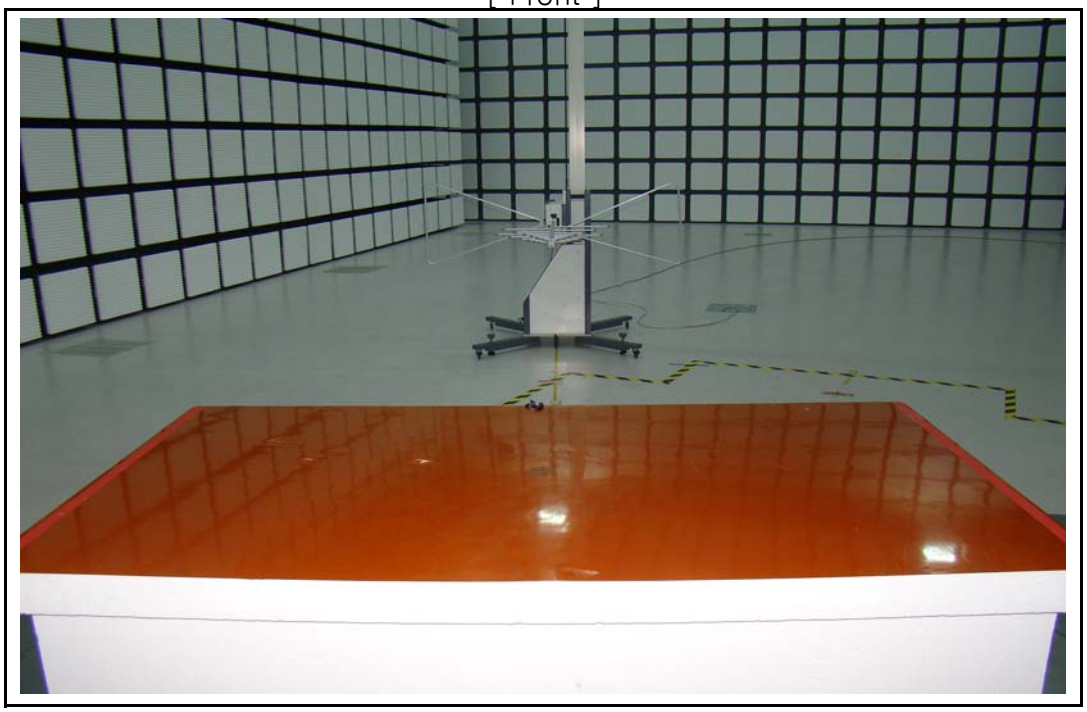
Test Date :

Frequency (MHz)	Correction Factor		Line (H/N)	Quasi-peak Value			Average Value		
	Lisn (dB)	Cable (dB)		Limit (dBμV)	Reading (dBμV)	Result (dBμV)	Limit (dBμV)	Reading (dBμV)	Result (dB)
Remark	H : Hot Line, N : Neutral Line *Correction Factor = Lisn + Cable *Result = Correction Factor + Reading								

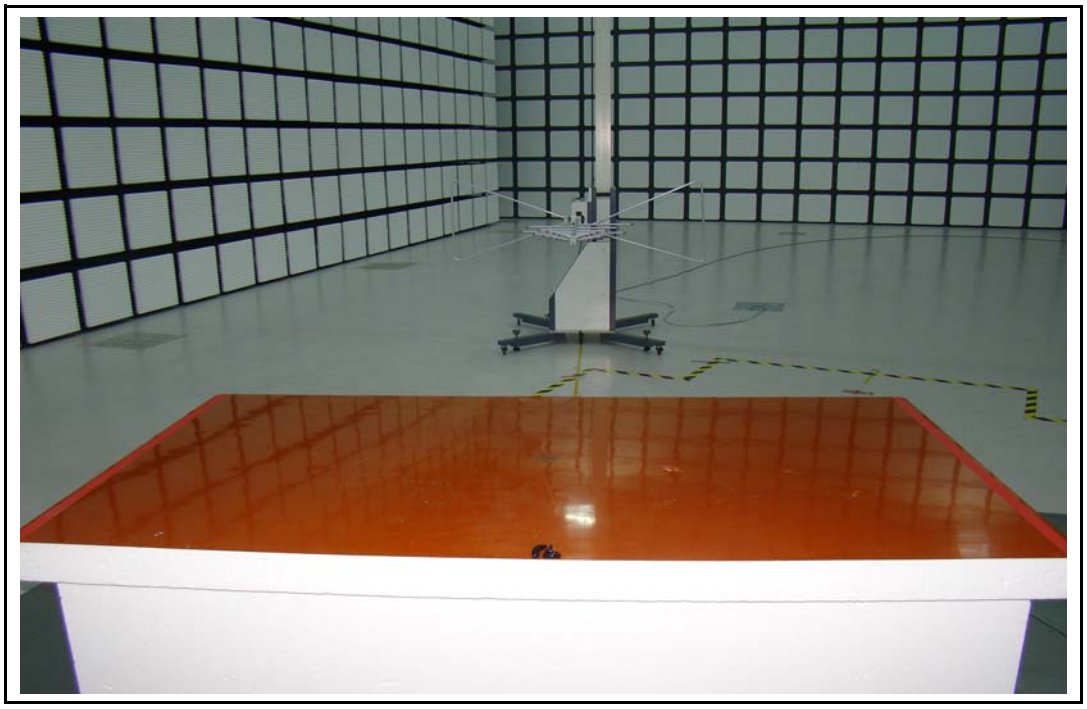
12. Photographs of test setup

12.1.Setup for Radiated Test : 30 ~ 1 000 MHz

[Front]



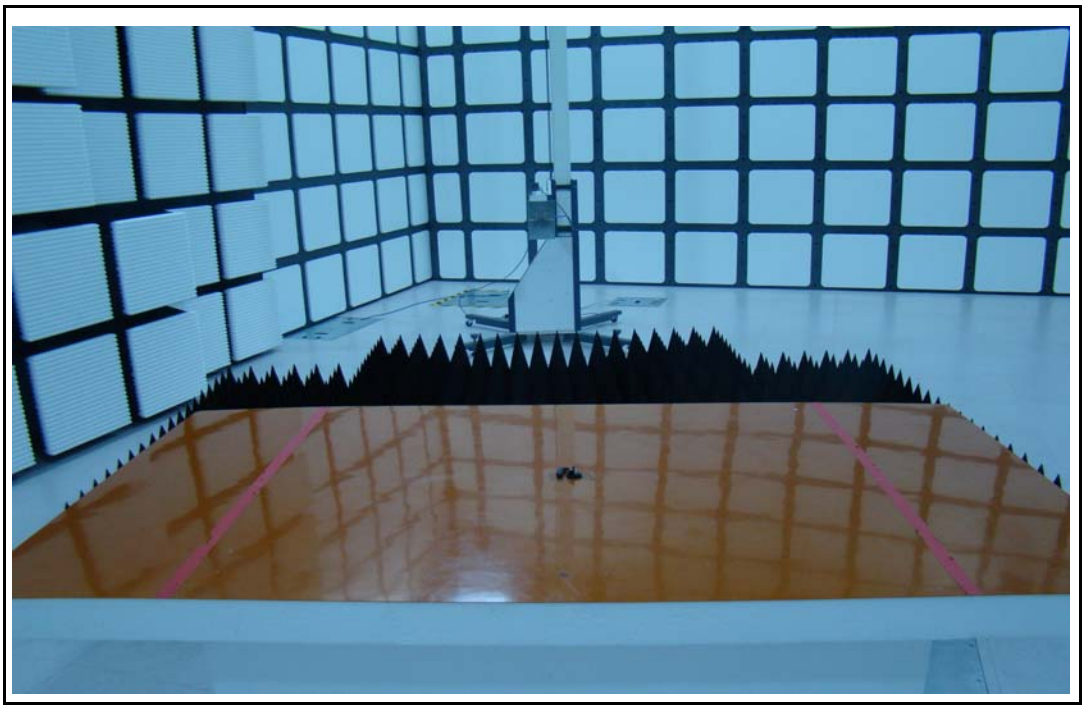
[Rear]



12.2. Setup for Radiated Test :Above 1 000 MHz

[Front]

[Rear]



12.3. Setup for Conducted Test : 0.15 ~ 30 MHz

[Front]

N/A

[Rear]

N/A

12.4. Photographs of EUT

[Front]

[Rear]

Appendix 1. Special diagram for Bluetooth (N/A)

Appendix 2. Antenna Requirement

1. Antenna Requirement

1.1 Standard Applicable

For intentional device, according to FCC 47 CFR Section 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.

And according to FCC 47 CFR Section 15.204

1.2 Antenna Connected Construction

The antenna types used in this product are Intergrated SMD antenna . The maximum Gain of this antenna is 2.88 dBi. (Polarization : Linear)