Test Report for FCC & IC

IC : 10330A-CS50

FCC ID : YW6CS50

Report Number		ESTF151403-005		
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) , KDB 558074 D01(2013) , IC RSS-210(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, CS11, CS55 (Classification based on the buyer, the same product)

Contents

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	: Bluetooth (DSSS)
Transfer Rate	: 1 Mbps
Number of Channel	: 40 ch
PEAK Output Power	: DSSS : 8.67 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) & KDB558074 D01(2013)

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
Standard	IC Standard	Test Type	Result	Remark	Limit
15.207	RSS-Gen 7.2.2	AC Power Conducted Emission	Pass	Meet the requirement	
15.205 & 15.209	A8.5	Restricted band / Intentional Radiated Emission	Pass	Meet the requirement	
15.247(a)(2)	A8.2(a)	6 dB Bandwidth	Pass	Meet the requirement	Min. 500 kHz
	RSS-Gen 4.6.1	99 % Bandwidth			
15.247(b)(3)	A8.4(4)	Maximum Peak/average ouput power	Pass	Meet the requirement	Max. 30 dBm
15.247(c)	A8.5	Transmitter Radiated Emission	Pass	Meet the requirement	Table 15.209
15.247(e)	A8.2(b)	Power Spectral Density	Pass	Meet the requirement	Max. 8 dBm
15.247(d)	A8.5	Band Edge Measurement	Pass	Meet the requirement	20 dB less
15.107	RSS-Gen 7.2.2	Receiver conducted Emission	Pass	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	21	2444 MHz
1	2404 MHz	22	2446 MHz
2	2406 MHz	23	2448 MHz
3	2408 MHz	24	2450 MHz
4	2410 MHz	25	2452 MHz
5	2412 MHz	26	2454 MHz
6	2414 MHz	…	…
…	…	39	2480 MHz
20	2442 MHz		

b. Measurement Channel : Bluetooth : Low(2402 MHz), Middle(2442 MHz),High(2480 MHz)

c. Test Mode : Continuous Output, DSSS

d. Test rate : 1 Mbps

4.2 EUT Operation.

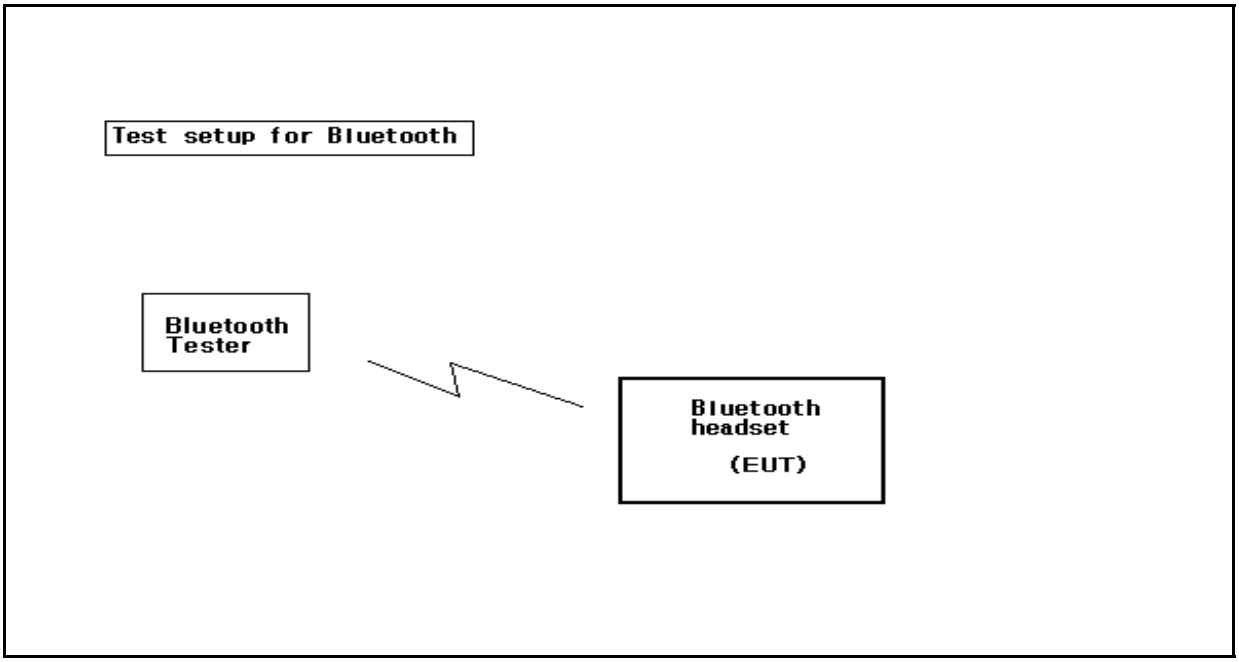
* The EUT was in the following operation mode during all testing

* 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	

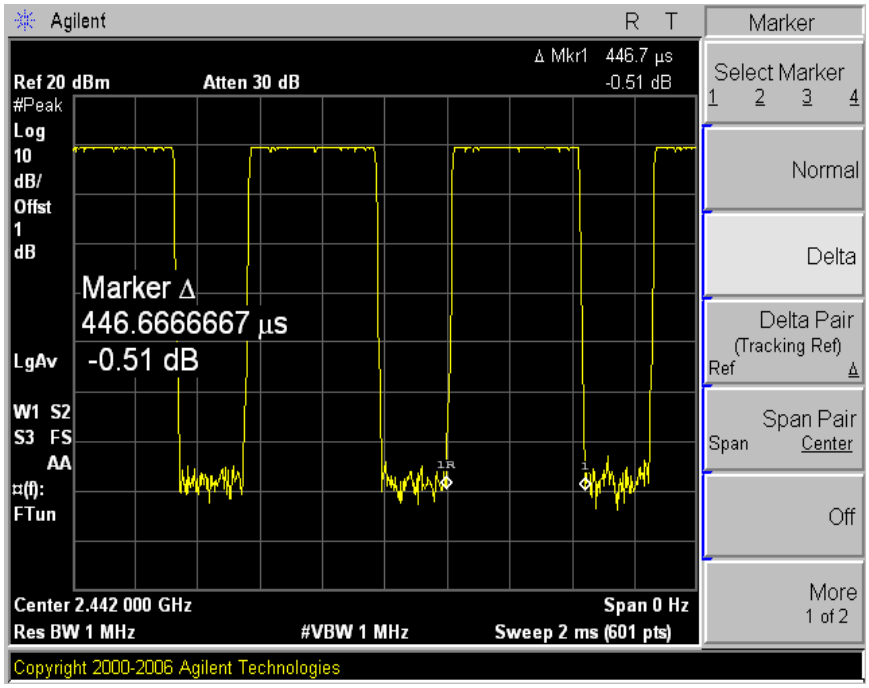
4.5 Cable Connecting

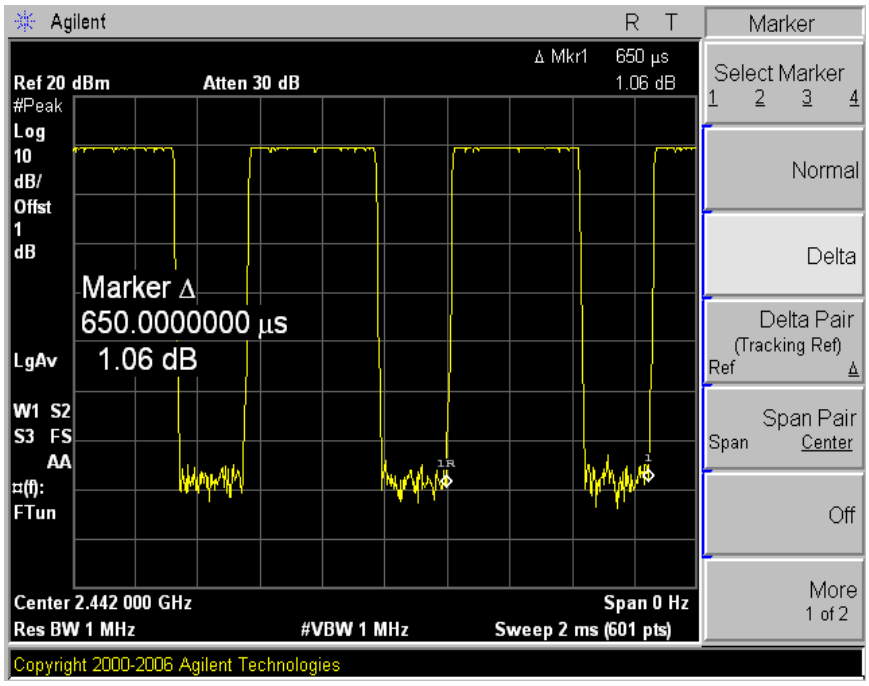
Start Equipment		End Equipment		Cable Standard		Remark
Name	I/O port	Name	I/O port	Length	Shielded	
Bluetooth headset	Wireless(BT)	Bluetooth Tester	Wireless(BT)	-	-	

4.6 DUTY CYCLE OF TEST SIGNAL

Duty cycle is < 98%, duty factor shall be considered.

Duty cycle = 0.4467/0.65=0.687, Duty factor = 10*log(1/0.687)=1.63





5. DTS bandwidth

5.1 Test procedure

558074 D01 DTS Meas Guidance v03 8.2 Option 2 :The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described above (i.e., RBW = 100 kHz, VBW ≥ 3 RBW, peak detector with maximum hold) is implemented by the instrumentation function. When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB.

5.2 Test instruments and measurement setup

The spectrum analyzer is set to as following.

. RBW= 100 KHz

. VBW≥ 3 x RBW

. Span= 5 MHz

. Sweep= suitable duration based on the EUT specification.

Limits : FCC § 15.247(a)(2) , IC RSS-210 A8.2(a)

6dB Bandwidth Test Instruments

Description	Model	Serial Number	Cal. Due Date
Spectrum Analyzer	E4440A	US42041291	2015-01-23
RF Cable	Length: 6cm	-	
-Spectrum Analyzer <=> EUT	Loss: 1.0dB	-	

5.3 Measurement results

EUT	Bluetooth headset	MODEL	CS50
MODE	DSSS	ENVIRONMENTAL CONDITION	24.0 ℃, 44.0 % R.H.
INPUT POWER	5Vd.c.		

Channel Frequency (MHz)	Emission bandwidth	Bandwidth at 6dB below(MHz)	Minimum Limit (MHz)	PASS/FAIL
2402	1.05 MHz	0.68	0.5	PASS
2442	1.04 MHz	0.67	0.5	PASS
2480	1.05 MHz	0.71	0.5	PASS

5.4 Trace data

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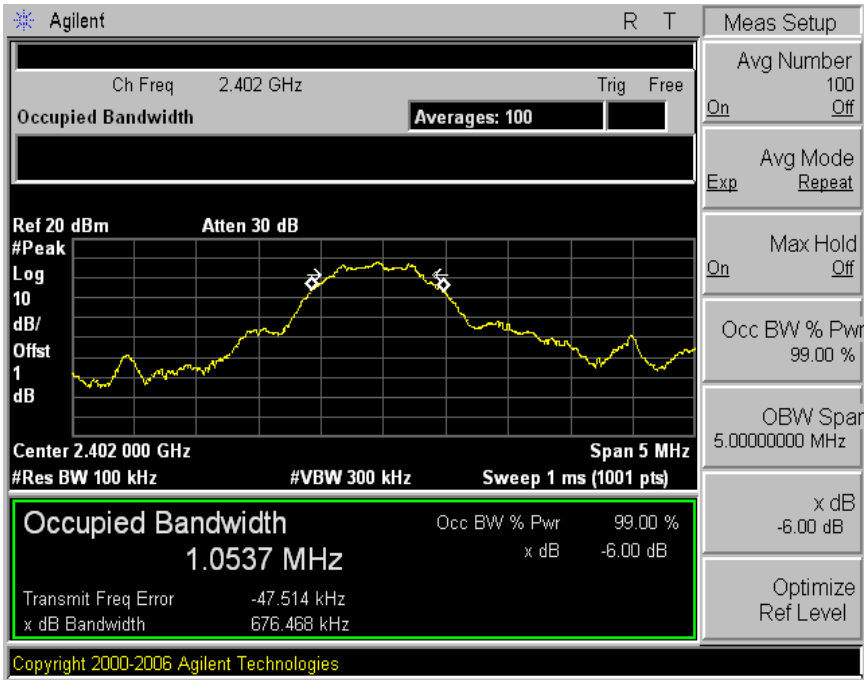

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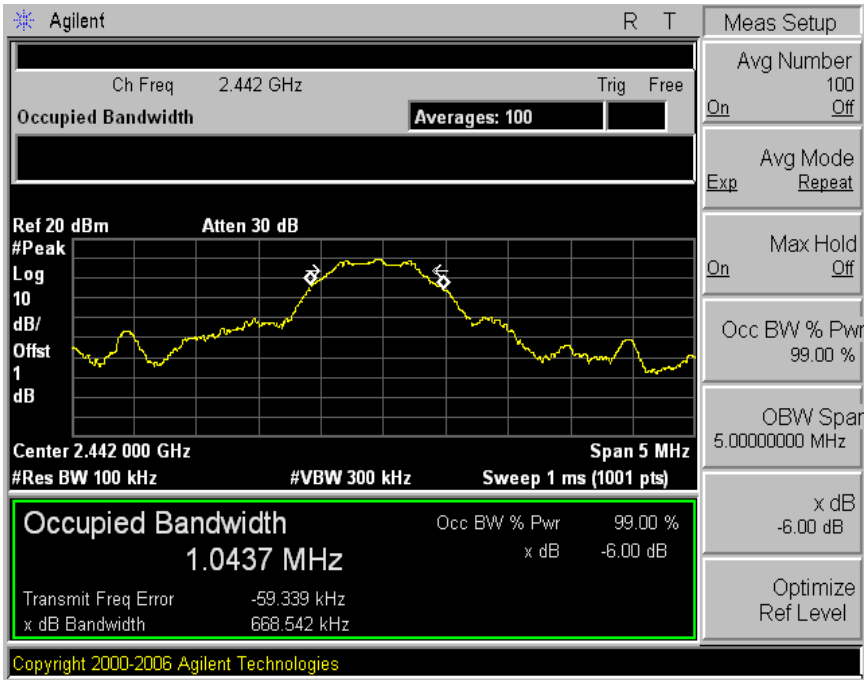

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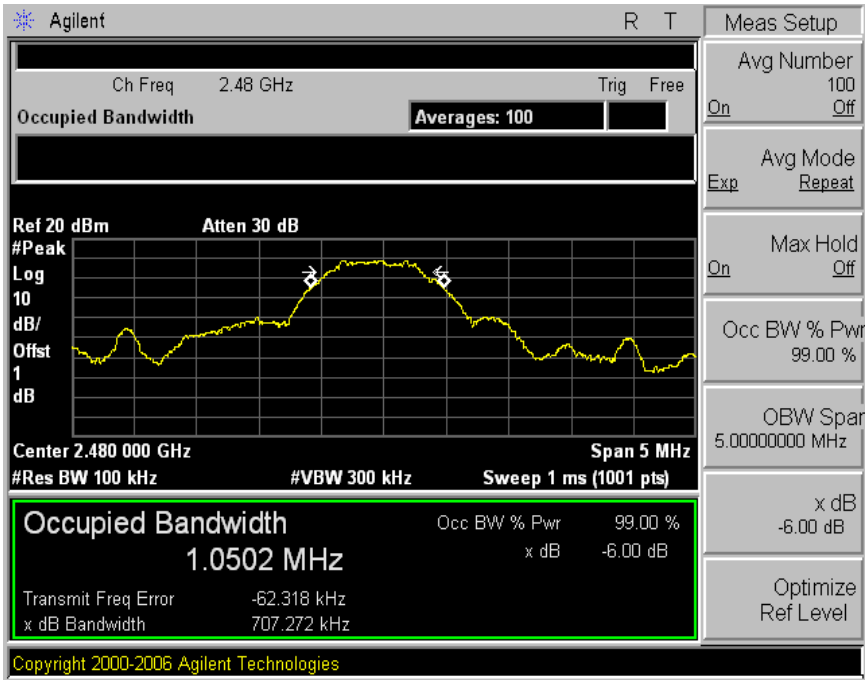

Agilent
R T
Meas Setup
Ch Freq 2.48 GHz
Trig Free
Occupied Bandwidth
Averages: 100
Avg Number
100
On Off
Avg Mode
Exp Repeat
Ref 20 dBm
Atten 30 dB
#Peak
Log
10
dB/
Offst
1
dB
Max Hold
On Off
Occ BW % Pwr
99.00 %
OBW Span
5.00000000 MHz
Center 2.480 000 GHz
Span 5 MHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 1 ms (1001 pts)
Occupied Bandwidth
1.0502 MHz
Occ BW % Pwr 99.00 %
x dB -6.00 dB
x dB
-6.00 dB
Transmit Freq Error -62.318 kHz
x dB Bandwidth 707.272 kHz
Optimize
Ref Level
Copyright 2000-2006 Agilent Technologies

6. Maximum peak conducted output power

6.1 Test procedure

KDB 558074 D01 DTS Meas Guidance V03r01 9.1.2 Integrated band power method

6.2 Test instruments and measurement setup

a) Set the RBW = 1 MHz.
b) Set the VBW ≥ 3 RBW
c) Set the span ≥ 1.5 x DTS bandwidth.
d) Detector = peak.
e) Sweep time = auto couple.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use the instrument's band/channel power measurement function with the band limits set equal to the DTS bandwidth edges (for some instruments, this may require a manual override to select peak detector). If the instrument does not have a band power function,

Limits : FCC § 15.247 , IC RSS-210 A8.4

Maximum Peak Output Power Test Instruments

Description	Model	Serial Number	Cal. Due Date
Spectrum Analyzer	E4440A	US42041291	2015-01-23
RF Cable	Length: 6cm	-	
-Spectrum Analyzer <=> EUT	Loss: 1.0 dB	-	

6.3 Measurement results

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

CHANNEL	Channel requency (MHz)	Conducted Power Output(dBm)			Limit[1W] (dBm)	PASS/FAIL
		Detector	(dBm)	(mW)		
0	2402	PEAK	7.04	5.06	30.0	PASS
20	2442	PEAK	8.78	7.55	30.0	PASS
39	2480	PEAK	9.38	8.67	30.0	PASS

7. Maximum conducted (average) output power

7.1 Test procedure

KDB 558074 D01 DTS Meas Guidance V03r01 9.2.2.4 Method AVGSA-2 (trace averaging across on and off times of the EUT transmissions, followed by duty cycle correction)

7.2 Test instruments and measurement setup

a) Measure the duty cycle, x, of the transmitter output signal as described in 6.0.
b) Set span to at least 1.5 times the OBW.
c) Set RBW = 1-5% of the OBW, not to exceed 1 MHz.
d) Set VBW ≥ 3 x RBW.
e) Number of points in sweep ≥ 2 span / RBW. (This gives bin-to-bin spacing ≤ RBW/2, so that narrowband signals are not lost between frequency bins.)
f) Sweep time = auto.
g) Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode.
h) Do not use sweep triggering. Allow the sweep to "free run".
i) Trace average at least 100 traces in power averaging (i.e., RMS) mode; however, the number of traces to be averaged shall be increased above 100 as needed such that the average accurately represents the true average over the on and off periods of the transmitter.
j) Compute power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function with band limits set equal to the OBW band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.
k) Add 10 log (1/x), where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times (because the measurement represents an average over both the on and off times of the transmission). For example, add 10 log (1/0.25) = 6 dB if the duty cycle is 25 %.

Maximum Peak Output Power Test Instruments

Description	Model	Serial Number	Cal. Due Date
Spectrum Analyzer	E4440A	US42041291	2015-01-23
RF Cable	Length: 6cm	-	
-Spectrum Analyzer <=> EUT	Loss: 1.0 dB	-	

7.3 Measurement results

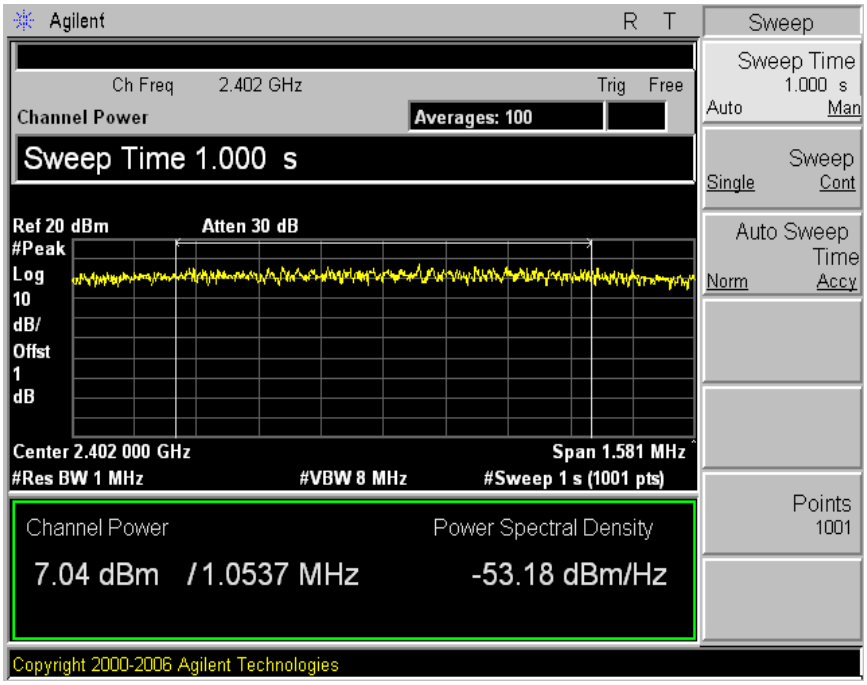
EUT	Bluetooth headset	MODEL	CS50
MODE	DSSS	ENVIRONMENTAL CONDITION	24 ℃, 43 % R.H.
INPUT POWER	5Vdc		

CHANNEL	Channel requency (MHz)	Conducted Power Output(dBm)			Measured + Duty Cycle(dBm)	Measured + Duty Cycle(mW)
		Detector	(dBm)	Duty Cycle		
0	2402	AVG	3.41	0.687	4.097	2.569
20	2442	AVG	5.23	0.687	5.917	3.906
39	2480	AVG	5.73	0.687	6.417	4.382

7.4 Trace data (Peak, Average)

(ch_0)

(Peak)



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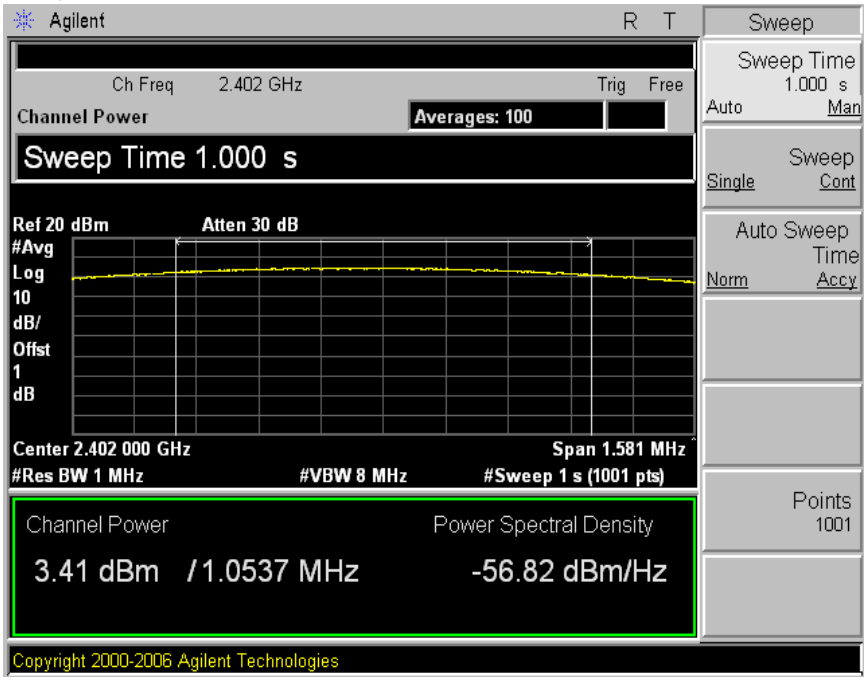

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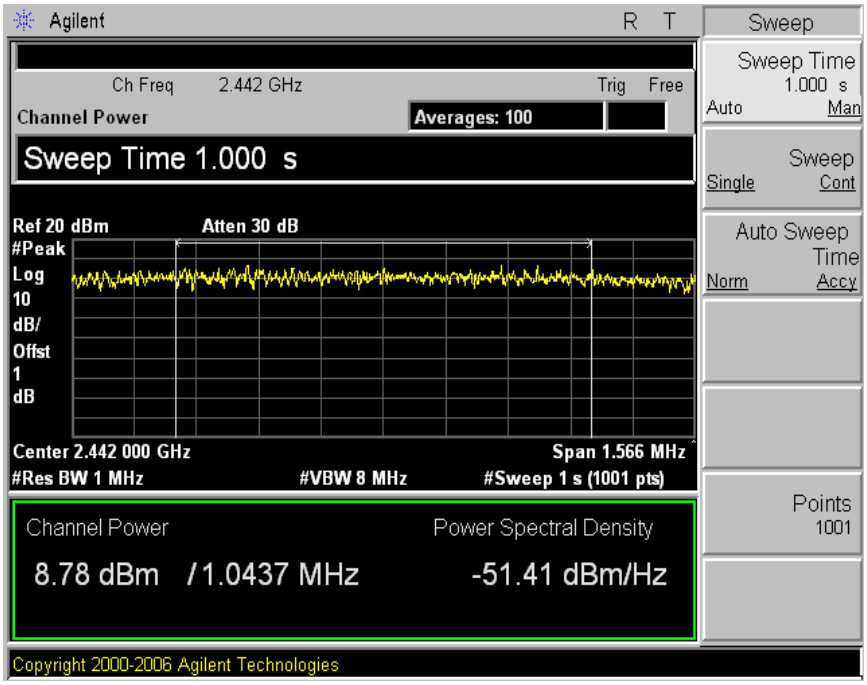
(Peak)



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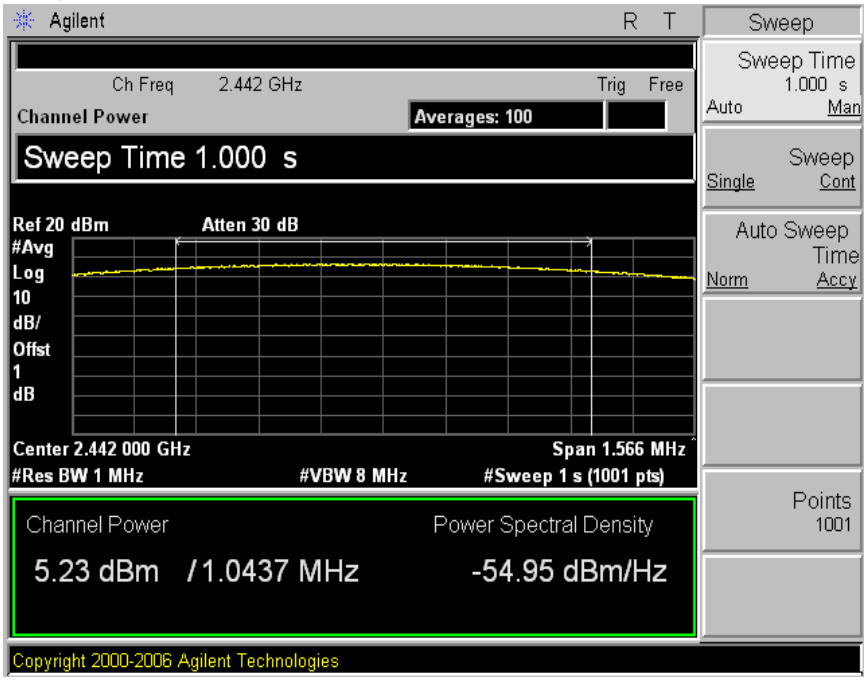
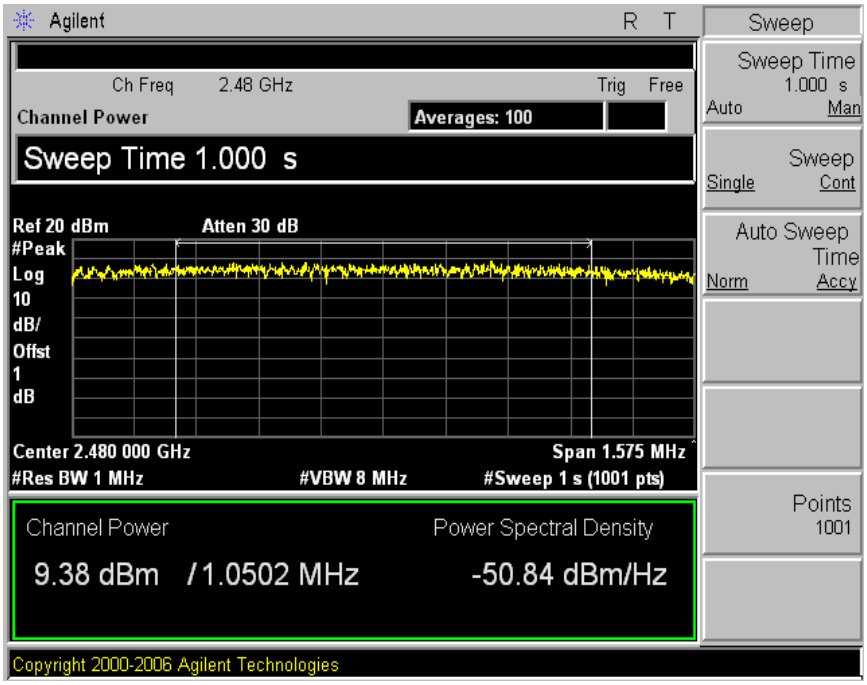


(ch_39)

(Peak)



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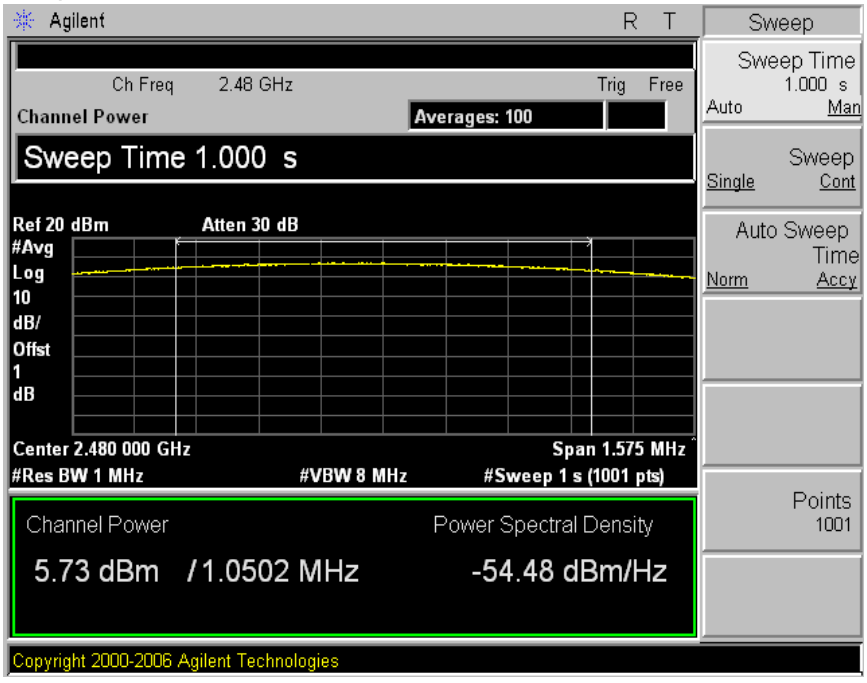


8. Maximum power spectral density level in the fundamental emission

8.1 Test procedure

KDB 558074 D01 DTS Meas Guidance V03r01 10.2 Method PKPSD (peak PSD)

8.2 Test instruments and measurement setup

The spectrum analyzer is set to as following.

a) Set analyzer center frequency to DTS channel center frequency.

b) Set the span to 1.5 times the DTS bandwidth.

c) Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.

d) Set the VBW ≥ 3 RBW.

e) Detector = peak.

f) Sweep time = auto couple.

g) Trace mode = max hold.

h) Allow trace to fully stabilize.

i) Use the peak marker function to determine the maximum amplitude level within the RBW.

j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

Limits FCC § 15.247 , IC RSS-210 A8.2

The peak power density Test Instruments

Description	Model	Serial Number	Cal. Due Date
Spectrum Analyzer	E440A	US42041291	2015-01-23
RF Cable	Length: 6cm	-	
-Spectrum Analyzer <=> EUT	Loss: 1.0 dB	-	

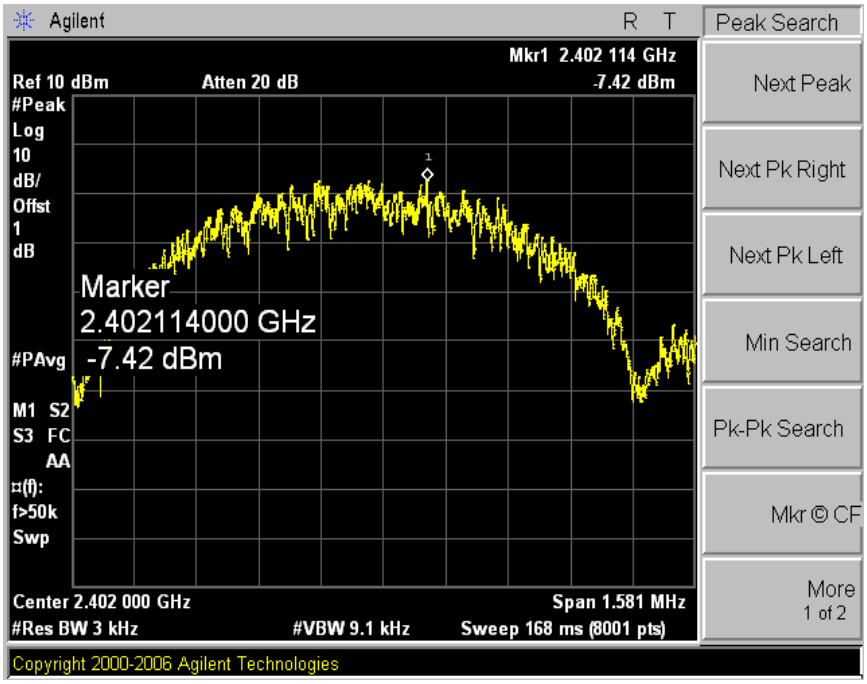
8.3 Measurement results

EUT	Bluetooth headset	MODEL	CS50
MODE	DSSS	ENVIRONMENTAL CONDITION	23.0 ℃, 43.0 % R.H.
INPUT POWER	5Vd.c.		

CHANNEL	Channel Frequency (MHz)	Measured Power Spectral Density (dBm)	Maximum Permissible Power Density (dBm/3kHz)	Margin
0	2402	-7.42	8.0	15.42
20	2442	-5.76	8.0	13.76
39	2480	-2.78	8.0	10.78

8.4 Trace data

(ch_0)



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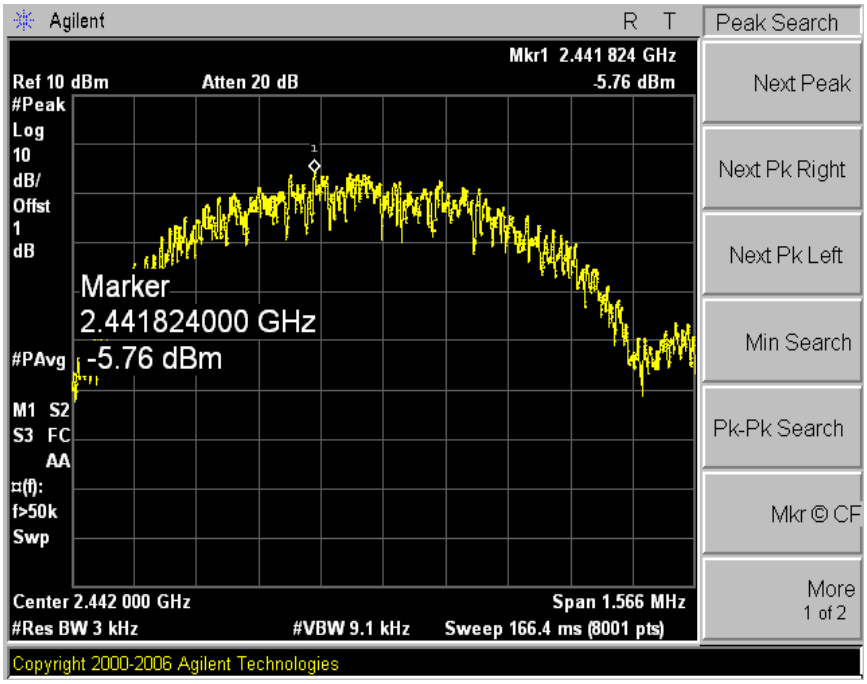

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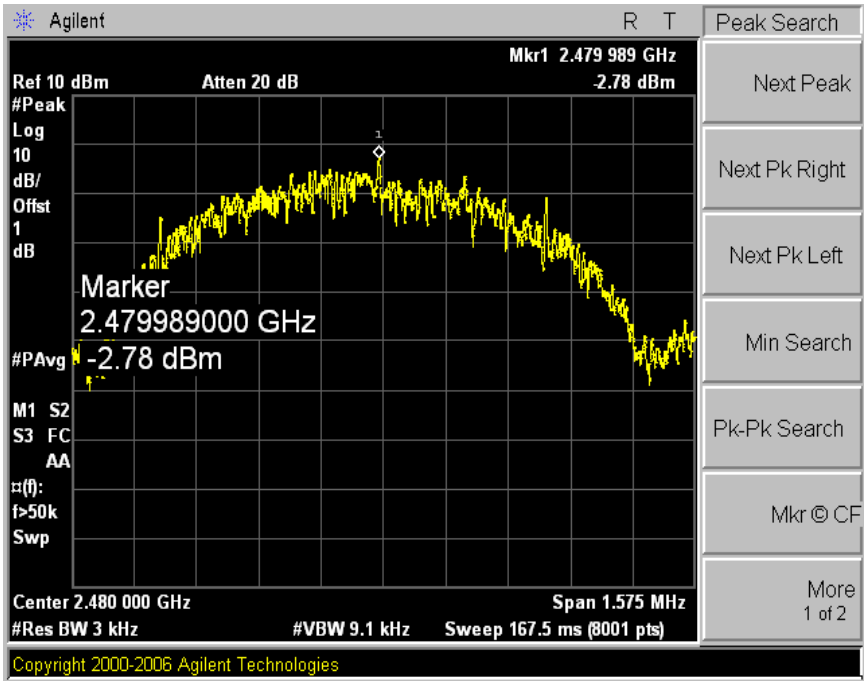

Agilent
R T
Peak Search
Mkr1 2.479 989 GHz
Ref 10 dBm
Atten 20 dB
-2.78 dBm
#Peak
Log
10
dB/
Offst
1
dB
Marker
2.479989000 GHz
-2.78 dBm
#PAvg
M1 S2
S3 FC
AA
¤(f):
f>50k
Swp
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr © CF
More
1 of 2
Center 2.480 000 GHz
Span 1.575 MHz
#Res BW 3 kHz
#VBW 9.1 kHz
Sweep 167.5 ms (8001 pts)
Copyright 2000-2006 Agilent Technologies

9. Emissions in non-restricted frequency bands

9.1 Test procedure

KDB 558074 D01 DTS Meas Guidance V03r01 11.0 Emissions in non-restricted frequency

9.2 Test instruments and measurement setup

The spectrum analyzer is set to as following.

a) Set the center frequency and span to encompass frequency range to be measured.

b) Set the RBW = 100 kHz)

c) Set the VBW ≥ 3 x RBW)

d) Detector = peak.

e) Ensure that the number of measurement points ≥ span/RBW

f) Sweep time = auto couple.

g) Trace mode = max hold.

h) Allow trace to fully stabilize.

i) Use the peak marker function to determine the maximum amplitude level.

Limits FCC § 15.247 , IC RSS-210 A8.5

Band Edge&Out of Emission Test Instruments

Description	Model	Serial Number	Cal. Due Date
Spectrum Analyzer	E4440A	US42041291	2015-01-23
Spectrum Analyzer	FSV40	100939	2015-01-23
RF Cable	Length: 6cm		-
-Spectrum Analyzer <=> EUT	Loss: 1.0dB		-

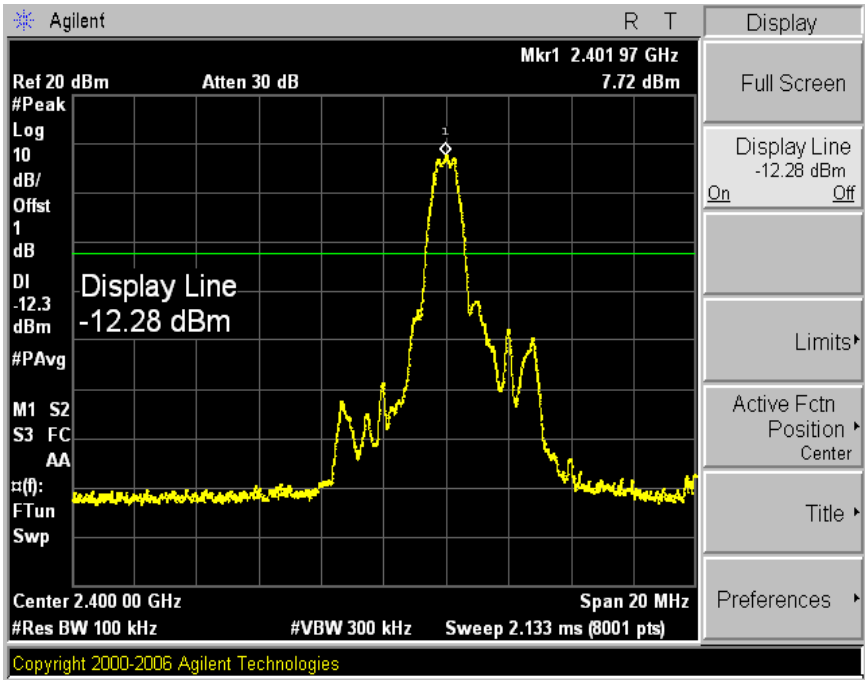
9.3 Measurement results of band-edge & out of emission

EUT	Bluetooth headset	MODEL	CS50
MODE	DSSS	ENVIRONMENTAL CONDITION	23.0 ℃, 43.0 % R.H.
INPUT POWER	5Vd.c.		

CHANNEL	Channel Frequency (MHz)	limit	PASS/FAIL
0	2402	20dBc	PASS
39	2480	20dBc	PASS

9.4 Trace data of band-edge & Out of Emission

(ch_0)



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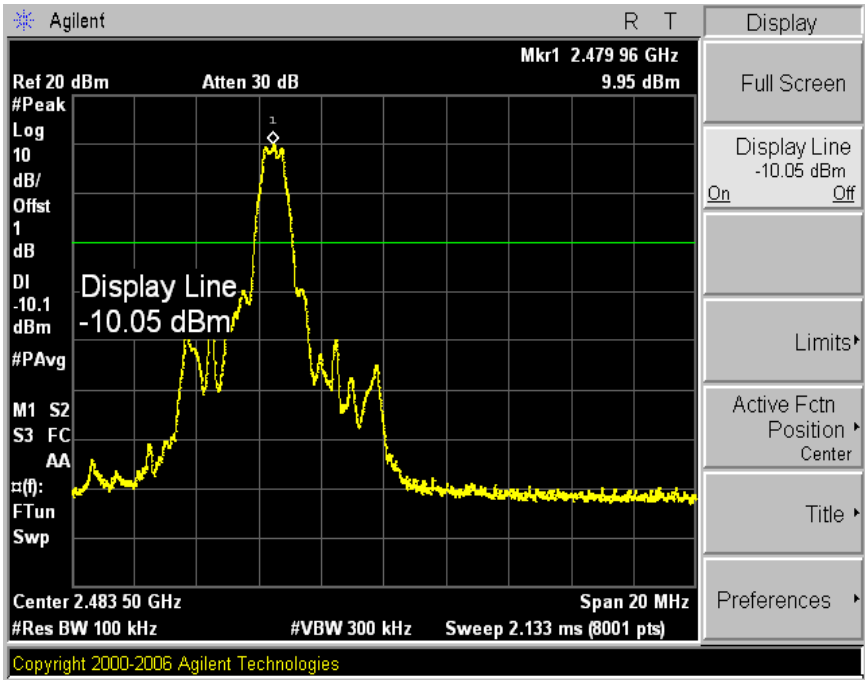

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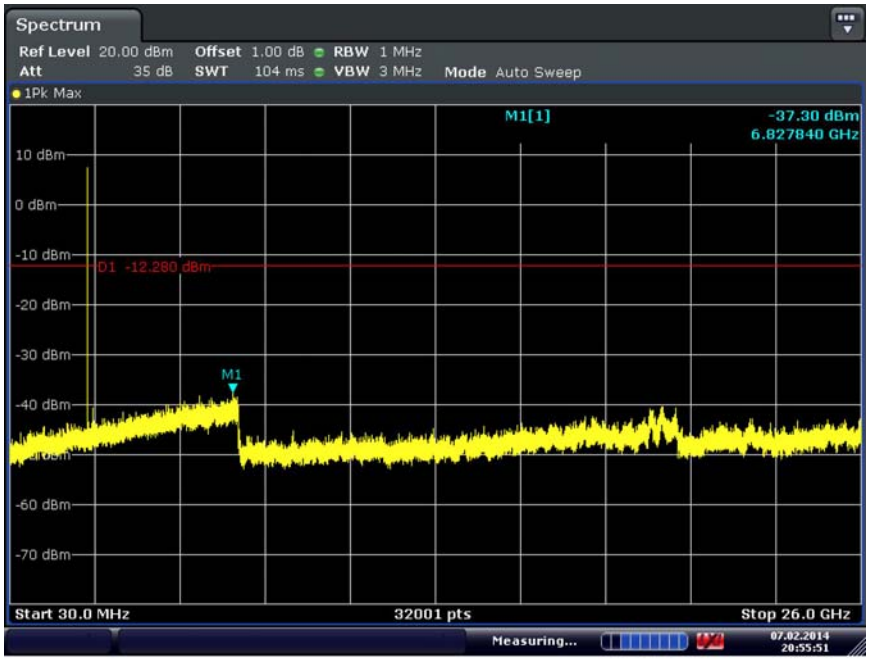
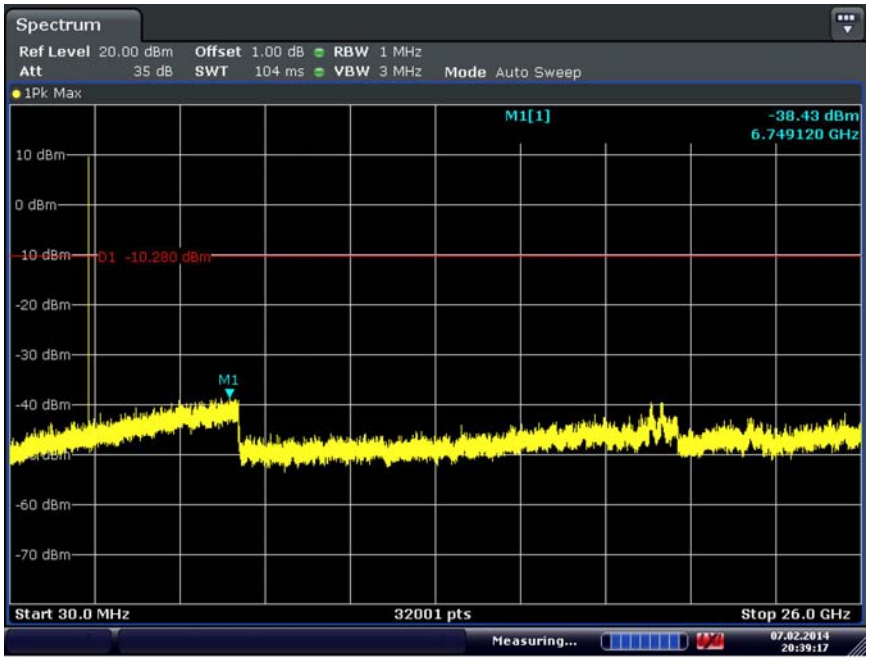
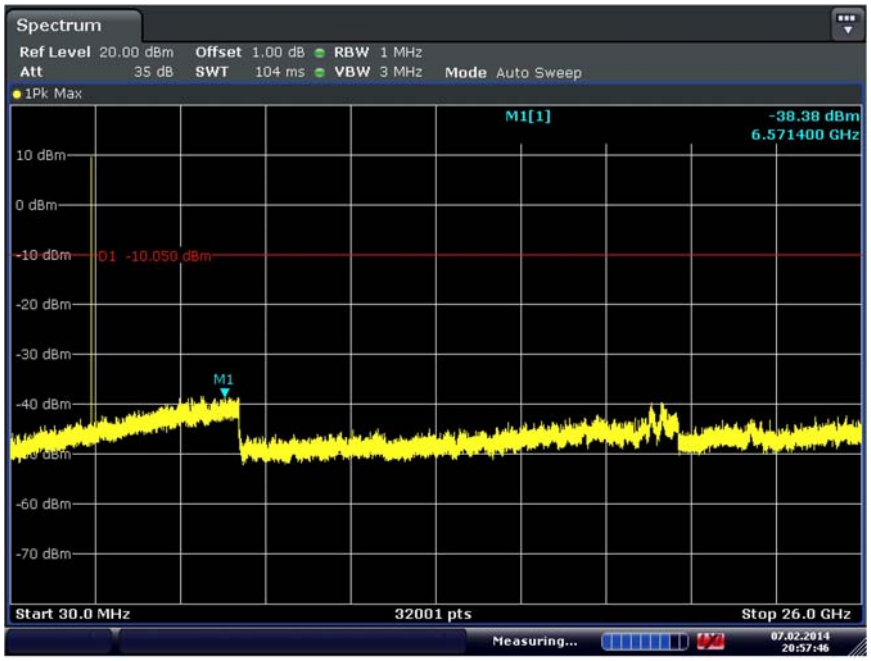

Spectrum
Ref Level 20.00 dBm Offset 1.00 dB RBW 1 MHz
Att 35 dB SWT 104 ms VBW 3 MHz Mode Auto Sweep
1Pk Max
M1[1] -37.30 dBm
6.827840 GHz
10 dBm
0 dBm
-10 dBm
D1 -12.280 dBm
-20 dBm
-30 dBm
M1
-40 dBm
-60 dBm
-70 dBm
Start 30.0 MHz
32001 pts
Stop 26.0 GHz
Measuring...
07.02.2014
20:55:51

(ch_20)


Spectrum
Ref Level 20.00 dBm Offset 1.00 dB RBW 1 MHz
Att 35 dB SWT 104 ms VBW 3 MHz Mode Auto Sweep
1Pk Max
M1[1]
-38.43 dBm
6.749120 GHz
10 dBm
0 dBm
-10 dBm
D1 -10.280 dBm
-20 dBm
-30 dBm
M1
-40 dBm
-60 dBm
-70 dBm
Start 30.0 MHz
32001 pts
Stop 26.0 GHz
Measuring...
07.02.2014
20:39:17

(ch_39)


Spectrum
Ref Level 20.00 dBm Offset 1.00 dB RBW 1 MHz
Att 35 dB SWT 104 ms VBW 3 MHz Mode Auto Sweep
1Pk Max
M1[1]
-38.38 dBm
6.571400 GHz
10 dBm
0 dBm
-10 dBm
D1 -10.050 dBm
-20 dBm
-30 dBm
M1
-40 dBm
-60 dBm
-70 dBm
Start 30.0 MHz
32001 pts
Stop 26.0 GHz
Measuring...
07.02.2014
20:57:46

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) & KDB 558074 D01 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

Bluetooth LE Mode

Temperature (°C) : 22.9 ℃

Humidity (% R.H.) : 53.3 % R.H.

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

Bluetooth LE Mode

Temperature (°C) : 23.1 ℃

Humidity (% R.H.) : 55.9 % R.H.

10.3 Measurement Instrument setting for Radiated Emission

10.3.1 Frequency range below 1 GHz

RBW: 120 kHz , VBW: 3 x RBW , Detector: Quasi-Peak

10.3.2 Frequency range above 1 GHz

Peak Power Measurement Procedure (KDB 558074 section 12.2.4)

a.RBW: 1 MHz , VBW: 3 MHz
b.Trace mode = max hold
c.Detector: Peak
d.Sweep time = auto

Average Power Measurement Procedures (KDB 558074 section 12.2.5.3)

a.Set analyzer center frequency to the frequency associated with the emission
b.RBW: 1 MHz , VBW: 1 kHz
c.Detector : Peak
d.Sweep time = auto

Note

Band	Duty cycle(%)	Ton (ms)	Ton + Toff (ms)	DCF=10*log(1/Duty) (dB)
Bluetooth	68.7	0.447	0.650	1.63

*This was applied of duty cycle factor for average value because of measured with the EUT transmitting continuously less than 98% duty cycle at its maximum power control level.

10.4 Test Data for Bluetooth (LE)

Test Date : 5-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)
47.20	7.46	V	1.0	12.88	1.19	40.00	21.53	18.47
52.70	6.17	V	1.0	12.79	1.23	40.00	20.19	19.81
72.00	11.03	V	1.0	10.85	1.40	40.00	23.28	16.72
87.90	10.99	H	3.0	8.00	1.56	40.00	20.56	19.44
144.00	3.88	H	2.0	12.34	1.95	43.50	18.17	25.33
317.90	6.53	V	1.0	13.95	2.80	46.00	23.28	22.72
652.30	3.37	H	1.8	20.57	3.99	46.00	27.93	18.07
815.00	4.48	H	1.2	22.81	4.46	46.00	31.75	14.25
933.70	2.96	V	1.0	23.95	4.78	46.00	31.69	14.31

Remark	H : Horizontal, V : Vertical TEST MODE : Bluetooth - LE (CH : 20 - 2442 MHz) *Checked in all 3 axis and the maximum measured data were reported.(Worst data is Z axis of position) *CL = Cable Loss(In case of below 1000 MHz) *Result Value = Reading + Ant Factor + Cable loss *The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection at frequency below 1 GHz.

10.4-1 Test Data for Bluetooth (LE)

Test Date 11-Jul-13 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)									
2365.60	26.78	H	1.0	27.45	5.60	0.00	74.00	59.83	14.17
2324.40	27.14	V	1.1	27.35	5.60	0.00	74.00	60.09	13.91
2390.00	25.08	H	1.0	27.51	5.60	0.00	74.00	58.19	15.81
2390.00	26.39	V	1.2	27.51	5.60	0.00	74.00	59.50	14.50
4804.00	49.84	H	1.1	31.36	-24.66	0.00	74.00	56.54	17.46
4804.00	49.37	V	1.2	31.36	-24.66	0.00	74.00	56.07	17.93
AV(RBW: 1 MHz VBW: 1 kHz)									
2365.60	13.72	H	1.0	27.45	5.60	1.63	54.00	48.40	5.60
2324.40	13.70	V	1.1	27.35	5.60	1.63	54.00	48.28	5.72
2390.00	13.69	H	1.0	27.51	5.60	1.63	54.00	48.43	5.57
2390.00	13.73	V	1.2	27.51	5.60	1.63	54.00	48.47	5.53
4804.00	41.36	H	1.1	31.36	-24.66	1.63	54.00	49.69	4.31
4804.00	40.10	V	1.2	31.36	-24.66	1.63	54.00	48.43	5.57

Remark

H : Horizontal, V : Vertical TEST MODE : Bluetooth - LE (CH : 0 - 2402 MHz)

*The TX signal wasn't detected from 3th harmonics.
*Checked in all 3 axis and the maximum measured data were reported.(Worst data is Z axis of position)
*Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain + Duty Cycle Correction

FYI
a. Ton Time : 0.447 ms
b. duty cycle : 68.7 %
c. DCF : 1.63 dB

10.4-2 Test Data for Bluetooth (LE)

Test Date 5-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)									
4884.00	51.54	H	1.2	31.50	-24.26	0.00	74.00	58.78	15.22
4884.00	50.87	V	1.0	31.50	-24.26	0.00	74.00	58.11	15.89
AV(RBW: 1 MHz VBW: 1 kHz)									
4884.00	41.22	H	1.2	31.50	-24.26	1.63	54.00	50.09	3.91
4884.00	40.05	V	1.0	31.50	-24.26	1.63	54.00	48.92	5.08

Remark

H : Horizontal, V : Vertical TEST MODE : Bluetooth - LE (CH : 20 - 2442 MHz)

*The TX signal wasn't detected from 3th harmonics.
*Checked in all 3 axis and the maximum measured data were reported.(Worst data is Z axis of position)
*Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain + Duty Cycle Correction

FYI
a. Ton Time : 0.447 ms
b. duty cycle : 68.7 %
c. DCF : 1.63 dB

10.4-3 Test Data for Bluetooth (LE)

Test Date 5-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	25.08	H	1.2	27.74	5.60	0.00	74.00	58.42	15.58
2483.50	24.60	V	1.2	27.74	5.60	0.00	74.00	57.94	16.06
2486.40	26.75	H	1.0	27.75	5.60	0.00	74.00	60.10	13.90
2485.75	26.36	V	1.1	27.74	5.60	0.00	74.00	59.70	14.30
4960.00	49.91	H	1.2	31.62	-23.93	0.00	74.00	57.60	16.40
4960.00	49.39	V	1.3	31.62	-23.93	0.00	74.00	57.08	16.92
AV(RBW: 1 MHz VBW: 1 kHz)									
2483.50	13.39	H	1.2	27.74	5.60	1.63	54.00	48.36	5.64
2483.50	13.33	V	1.2	27.74	5.60	1.63	54.00	48.30	5.70
2486.40	13.45	H	1.0	27.75	5.60	1.63	54.00	48.43	5.57
2485.75	13.43	V	1.1	27.74	5.60	1.63	54.00	48.40	5.60
4960.00	41.36	H	1.2	31.62	-23.93	1.63	54.00	50.68	3.32
4960.00	41.27	V	1.3	31.62	-23.93	1.63	54.00	50.59	3.41

Remark

H : Horizontal, V : Vertical TEST MODE : Bluetooth - LE (CH : 39 - 2480 MHz)

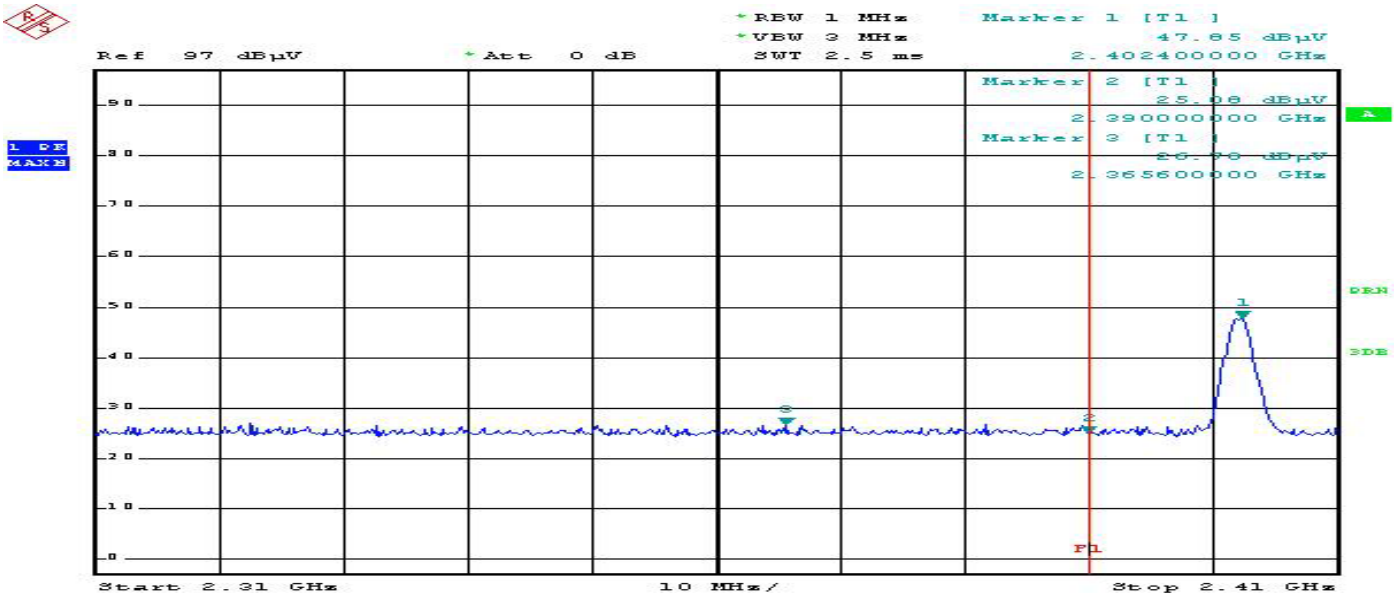
*The TX signal wasn't detected from 3th harmonics.
*Checked in all 3 axis and the maximum measured data were reported.(Worst data is Z axis of position)
*Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain + Duty Cycle Correction

FYI
a. Ton Time : 0.447 ms
b. duty cycle : 68.7 %
c. DCF : 1.63 dB

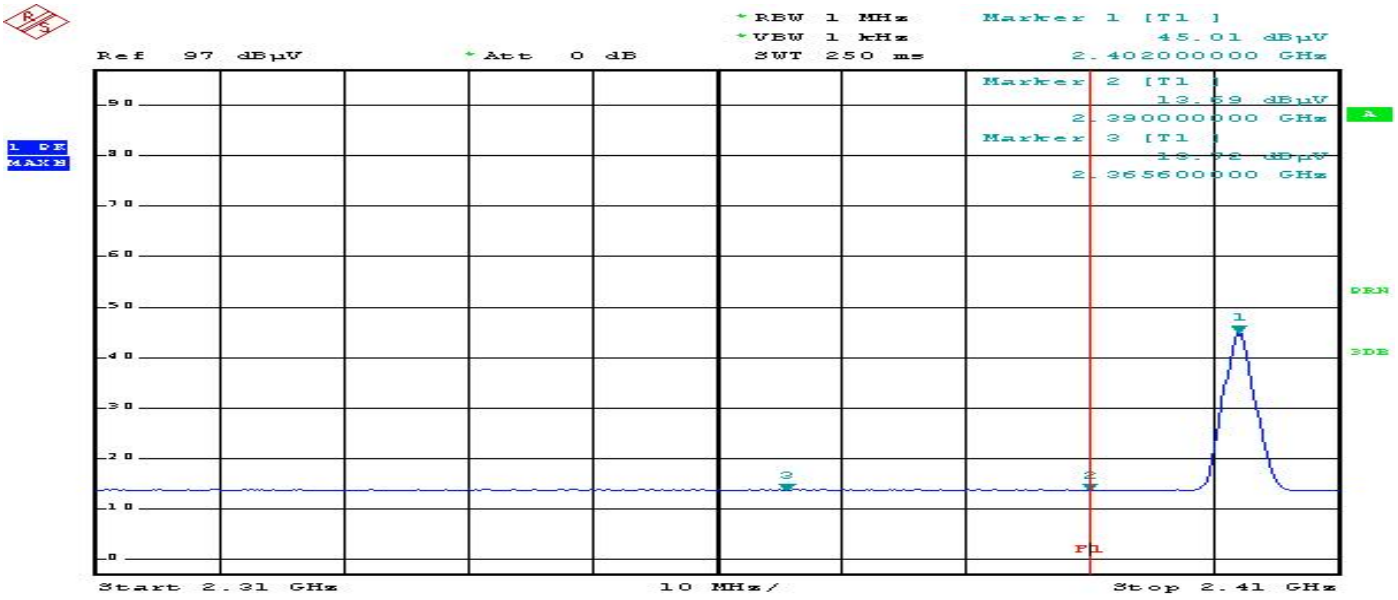
10.4 Restricted Band Edges for Bluetooth (LE)

Band Edges(CH Low)

Detector mode:Peak Polarity:Horizontal

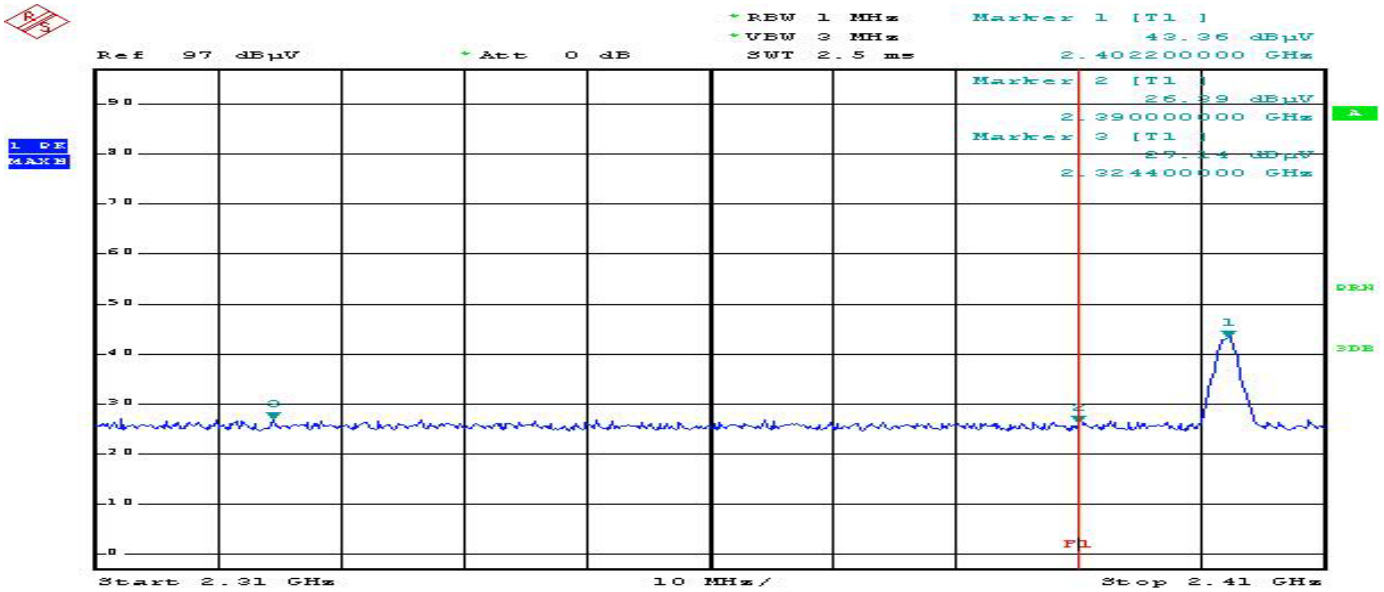


Detector mode:Average Polarity:Horizontal



Band Edges(CH Low)

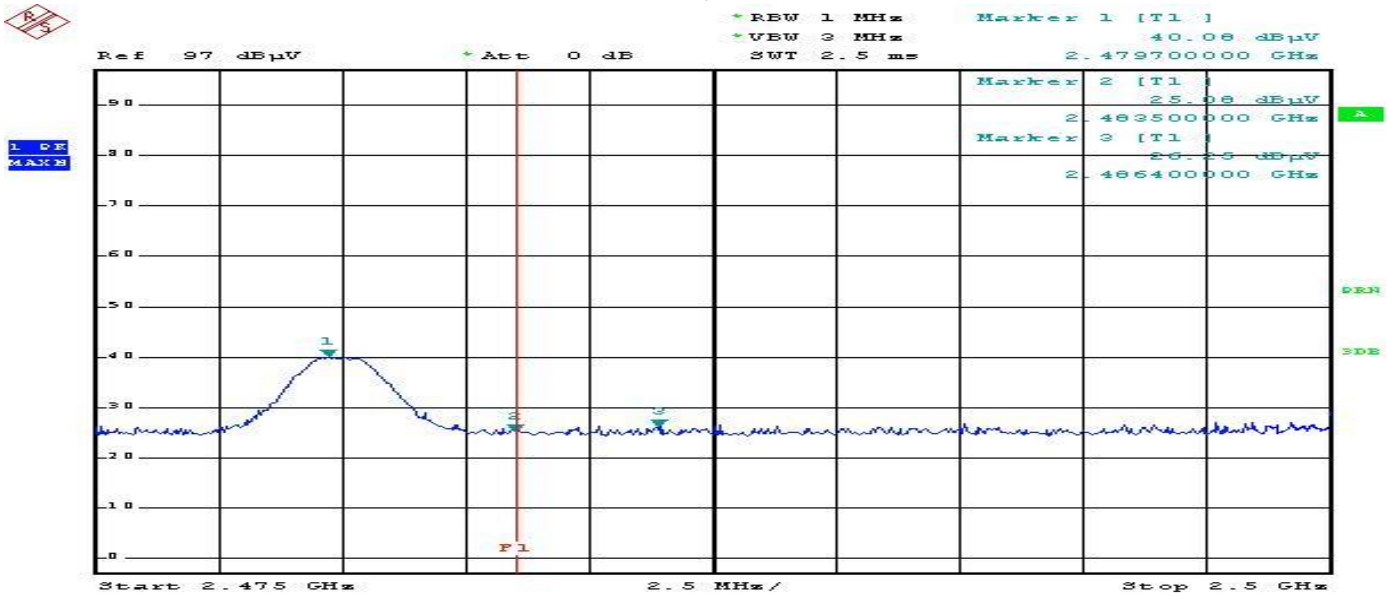
Detector mode:Peak Polarity:Vertical



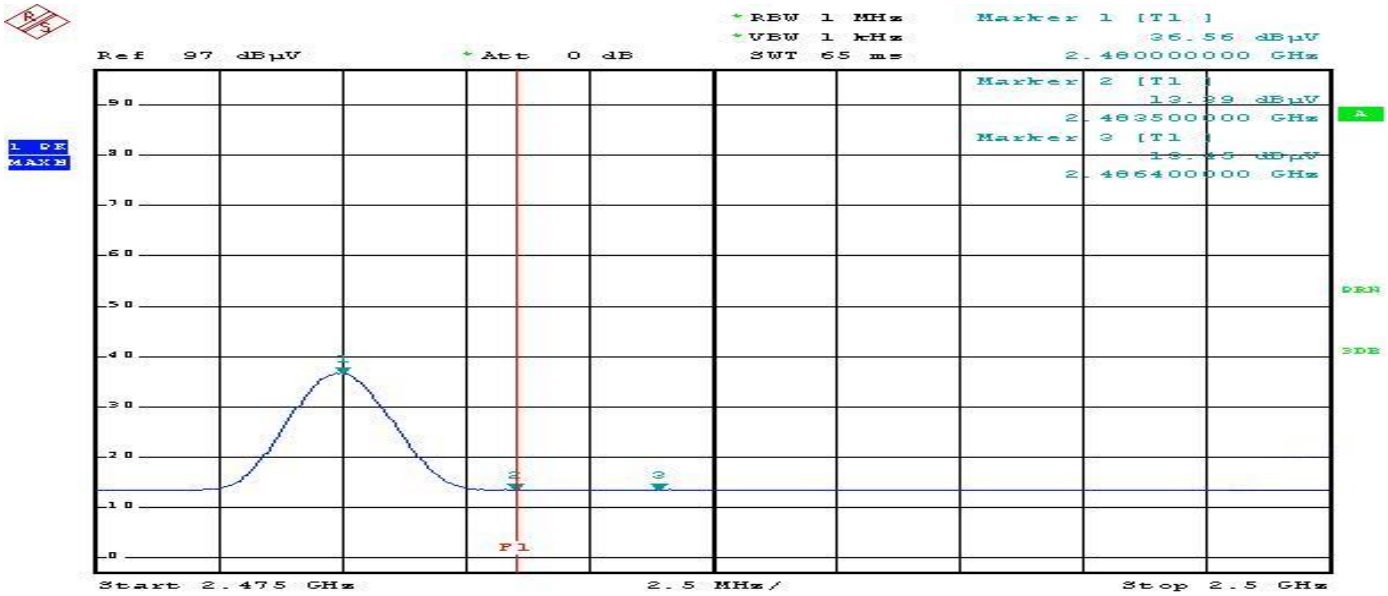
Detector mode:Average Polarity:Vertical

Band Edges(CH High)

Detector mode:Peak Polarity:Horizontal

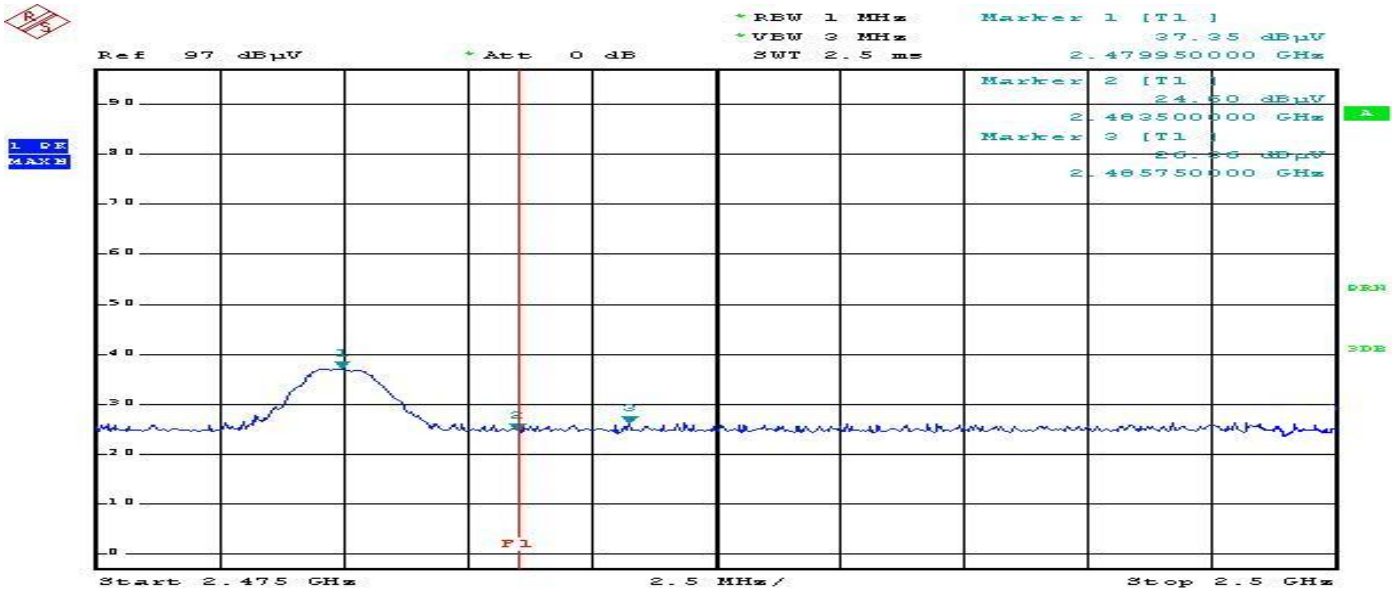


Detector mode:Average Polarity:Horizontal

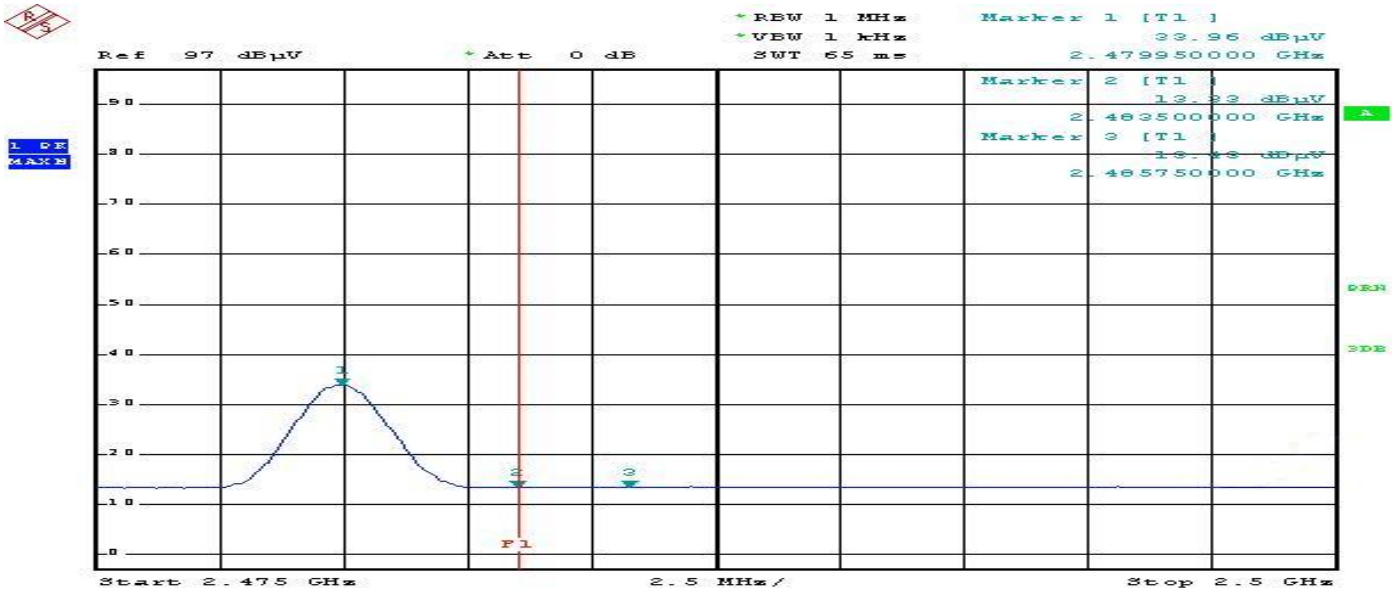


Band Edges(CH High)

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
EMI TEST Receiver	ESHS 10	Rohde & Schwarz	844077/018	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

11.2 Environmental Condition

Test Place :

Temperature (°C) :
Humidity (% R.H.) :

11.3 Test Data for Bluetooth (LE)(N/A)

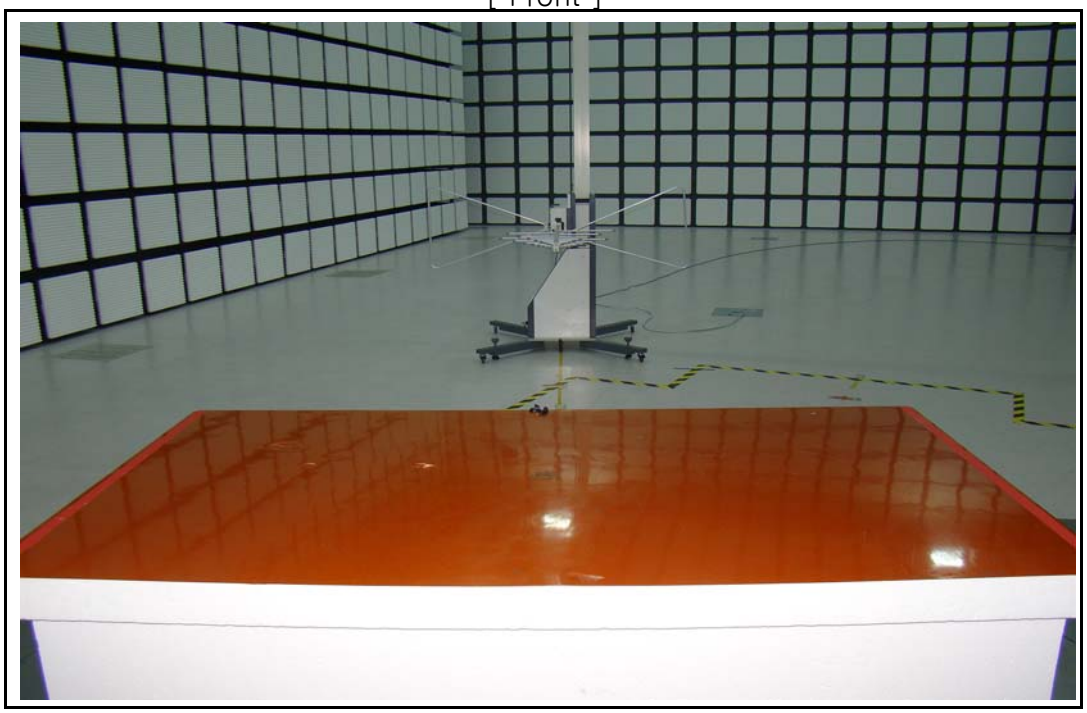
Test Date :

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								

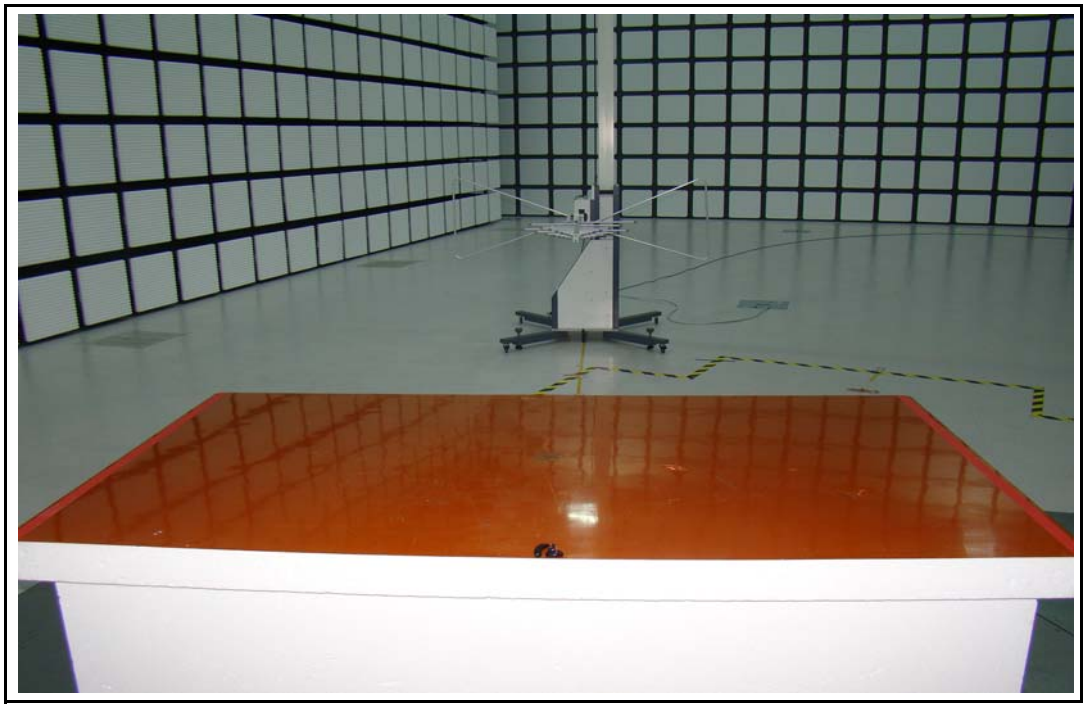
12. Photographs of test setup

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

[Front]

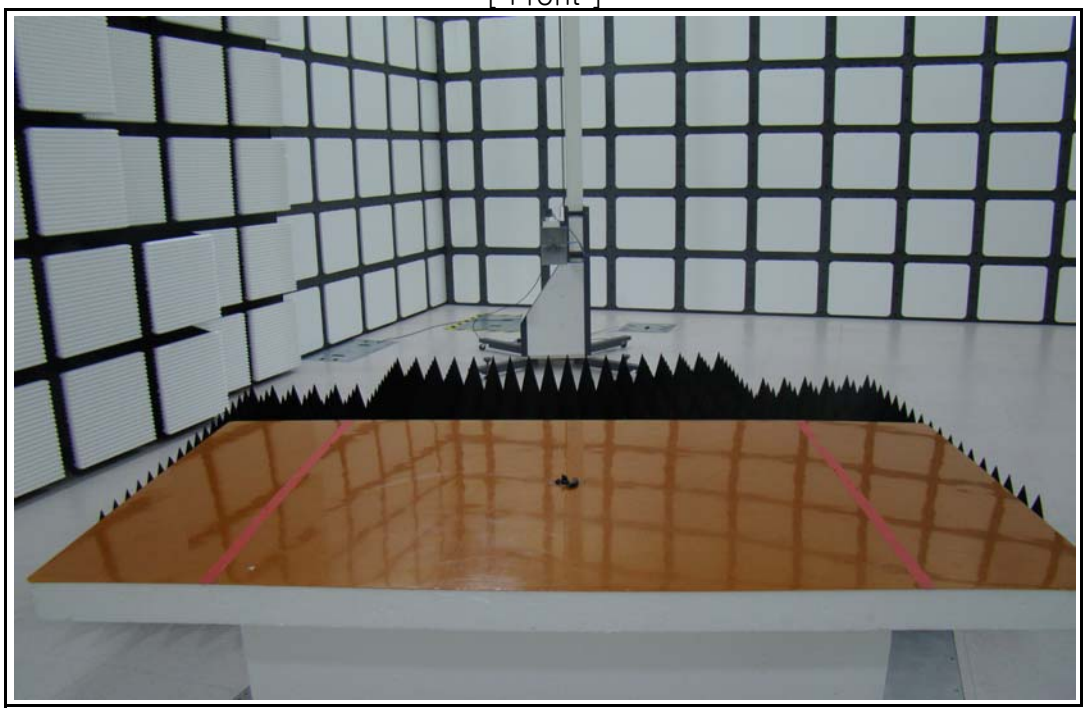


[Rear]

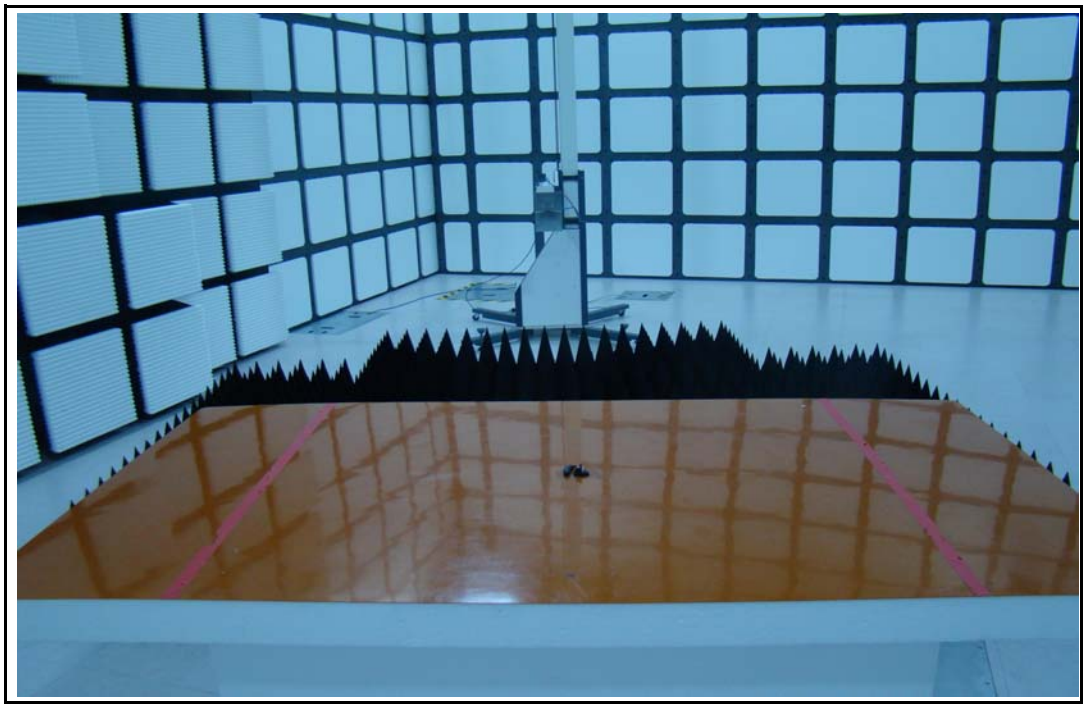


12.2.Setup for Radiated Test : Above 1 GHz

[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 (LE) (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.