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Projet: 09CA02127
File: TC8340
Report: 09CA02127-FCC
Date: February 16, 2009
Model: MiroCam Capsule Endoscope System

FCC Certification Report

for

Capsule Endoscope & Receiver

INTROMEDIC CO., LTD.

SUITE 1104, E&C VENTURE DREAM TOWER 6-CHA 197-28 GURO-
DONG, GURO-GU, SEOUL,

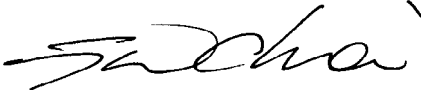

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Test Report Details

Report Number	09CA02127-FCC			
Applicant	Company Name	INTROMEDIC CO., LTD		
	Address	SUITE 1104, E&C VENTURE DREAM TOWER 6-CHA, 197-28 GURO-DONG, GURO-GU, SEOUL, KOREA		
Product	Product Name	Capsule Endoscope & Receiver		
	Model No.	MiroCam Capsule Endoscope System		
EUT is consisted of Capsule endoscope(MC1000-C), Receiver(MR2000-R) and Charger(MR1000-C)				
Other	FCC ID	VAXINTROMEDIC2	FCC Procedure	Certification
	Issued Date	02/16/2009	Tested Date	2008-12-17 ~2009-02-16
Test Result	Passed			
Standard	FCC CFR 47 Part 15 Subpart C			
Tested by	 Tested by Jeawoon Choi, Senior Project Engineer Conformity Assessment Services – 3014ASEO, UL Korea Ltd. February 16, 2009			
Reviewed by	 Kyungyong Kim, EMC Section Manager Conformity Assessment Services – 3014ASEO, UL Korea Ltd. February 16, 2009			

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Appendix 1. Spectral diagram



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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.

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
(Safety & Telecom. Test Lab)

EMC Test Lab : 58-1 Osan-Ri, GaNam-Myon, YeoJoo-Gun, KyungKi-Do, Korea
97-1 Hoiuk-Ri Majang-Myon, Icheon-city, KyungKi-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 : Filed Laboratory at Federal Communications Commission

VCCI : Granted Accreditation from Voluntary Control Council for Interference from ITE

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2. Description of EUT

2.1 Summary of Equipment Under Test (Bluetooth)

Product Name	:	Capsule Endoscope & Receiver
Model Number	:	MiroCam Capsule Endoscope System(MR 2000)
Modulation Type	:	FHSS(GFSK,8DPSK)
Transfer Rate	:	1Mbps,3Mbps
Number of Channel	:	79 ch
Serial Number	:	NONE
Manufacturer	:	INTROMEDIC CO., LTD
Country of origin	:	KOREA
Receipt Date	:	14-Nov-08
Input Voltage	:	(100-240)Va.c. ~ 50 /60Hz , 1.0A

2.2 General descriptions of EUT

– Capsule Endoscope & Receiver offers Bluetooth as a feature. The Bluetooth frequency hopping transceiver is designed to operate between 2400 and 2483.5MHz.

'– The system is designed to comply with all of the regulations in Section 15.247.

'– The product is categorically excluded from SAR requirements per 47CFR 1.1307(c) or 1.1307(d).



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3. Test Standards

Test Standard : FCC PART 15 (2007)

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

Test Method : ANSI C 63.4 (2003)

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

Summary of Test Results

Applied Standard : 47 CFR Part 15, Subpart C				
Standard	Test Type	Result	Remark	Limit
15.207	AC Power Conducted Emission	Pass	Meet the requirement	
15.209	Intentional Radiated Emission	Pass	Meet the requirement	
15.247(a)(1)	Carrier Frequency Separation & 20 Bandwidth	Pass	Meet the requirement	>25kHz
15.247(b)	Maximum Peak output power	Pass	Meet the requirement	30dBm(1W)
15.247(a)(1)(ii)	Number of Hopping Frequency	Pass	Meet the requirement	>75
15.247(c)	Transmitter Radiated Emission	Pass	Meet the requirement	
15.247(a)(1)(iii)	Time of Occupancy (Dwell Time)	Pass	Meet the requirement	<400ms
15.247(c)	Band Edge Measurement	Pass	Meet the requirement	

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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(2402MHz), Middle(2441MHz),High(2480MHz)

c. Test Mode : FHSS, 8DPSK

d. Test rate : 1Mbps , 3Mbps



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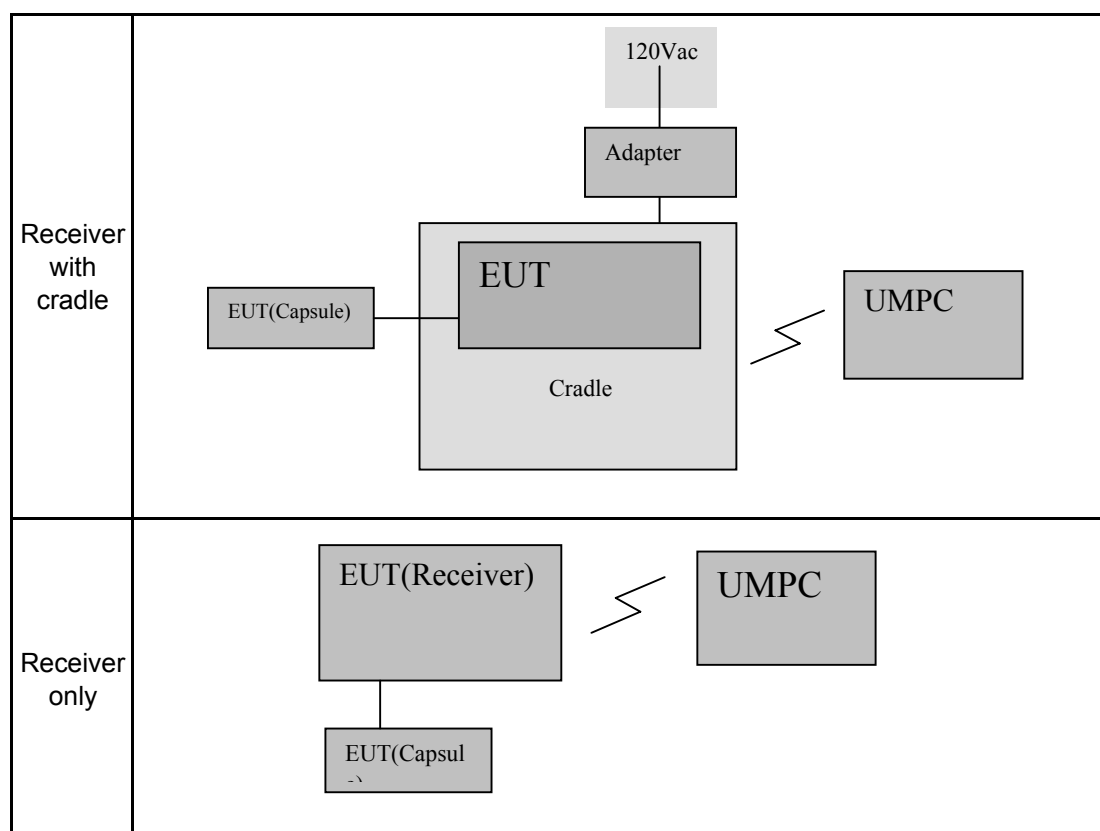
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4.2 EUT Operating condition.

Mode#	Mode	Frequency	Channel	Modulation	Data Rate	Rem.
#1	BT	2402MHz	0	FHSS (GFSK)	1Mbps	-
		2441MHz	39			
		2480MHz	78			
#2	EDR	2402MHz	0	FHSS (8DPSK)	3Mbps	-
		2441MHz	39			
		2480MHz	78			
#3	Inquiry	N/A	N/A	GFSK	1Mbps	-

Note : All modes listed above table were verified and recorded in this report.

4.3 Configuration and Peripherals



Note : Receiver with cradle mode was tested as the worst condition for all tests



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4.4 EUT and Support equipment

Equipment Name		S/N	Manufacturer	Remark (FCC ID)
Capsule Endoscope & Receiver	MiroCam Capsule Endoscope System(MR 2000)	NONE	INTROMEDIC CO., LTD	EUT
ADAPTER	JMW128KA0902F02	NONE	AULT KOREA CORP	
Battery charger	MR1000-C	8260022	AULT KOREA CORP	

4.5 Cable Connecting

Start Equipment		End Equipment		Cable Standard		Remark
Name	I/O port	Name	I/O port	Length	Shielded	
Capsule Endoscope & Receiver	Power	Battery charger	Power	0	No	
Battery charger	Power	Adapter	—	2	No	



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5. Carrier Frequency Separation, 20dB Bandwidth & Occupied Bandwidth(99%)

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 2/3 of 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= 300KHz
- . 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	E4407B	US42041281	09/11/2009
Bluetooth Tester	TC-3000A	3000A570224	12/05/2009
Dual Directional Coupler	778D	16502	02/28/2009
-Spectrum Analyzer <=> EUT	Loss:	-	

5.3 Measurement results

EUT	Capsule Endoscope & Receiver	MODEL	MiroCam Capsule Endoscope System
MODE	FHSS	ENVIRONMENTAL CONDITION	25℃, 43%RH
INPUT POWER	120Vac, 60Hz		

5.3.1 Carrier Frequency Separation, 20dB Bandwidth

CHANNEL	Channel Frequency (MHz)	Bandwidth at 20dB below(kHz)	Channel Separation (kHz)	Limit (kHz)	PASS/FAIL
0	2402	926.6	1000.0	>617.3	PASS
39	2441	971.9	1000.0	>647.9	PASS
78	2480	946.5	1000.0	>631	PASS

CHANNEL (EDR)	Channel Frequency (MHz)	Bandwidth at 20dB below(kHz)	Channel Separation (kHz)	Limit (kHz)	PASS/FAIL
0	2402	1316.0	1000.0	>877.3	PASS
39	2441	1354.0	1000.0	>902.7	PASS
78	2480	1312.0	1000.0	>874.7	PASS

CHANNEL	Channel Frequency (MHz)	Bandwidth at 20dB below(kHz)	Channel Separation (kHz)	Limit (kHz)	PASS/FAIL
Inquiry mode	-	252.3	2000.0	>168.2	PASS



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5.3.2 99% Occupied Bandwidth Measurement results

CHANNEL(BT)	Channel Frequency (MHz)	99% Occupied Bandwidth(MHz)	Remark
0	2402	903.2	-
39	2441	901.4	-
78	2480	897.9	-

CHANNEL (EDR)	Channel Frequency (MHz)	99% Occupied Bandwidth(MHz)	Remark
0	2402	1199.5	-
39	2441	1211.8	-
78	2480	1193.5	-

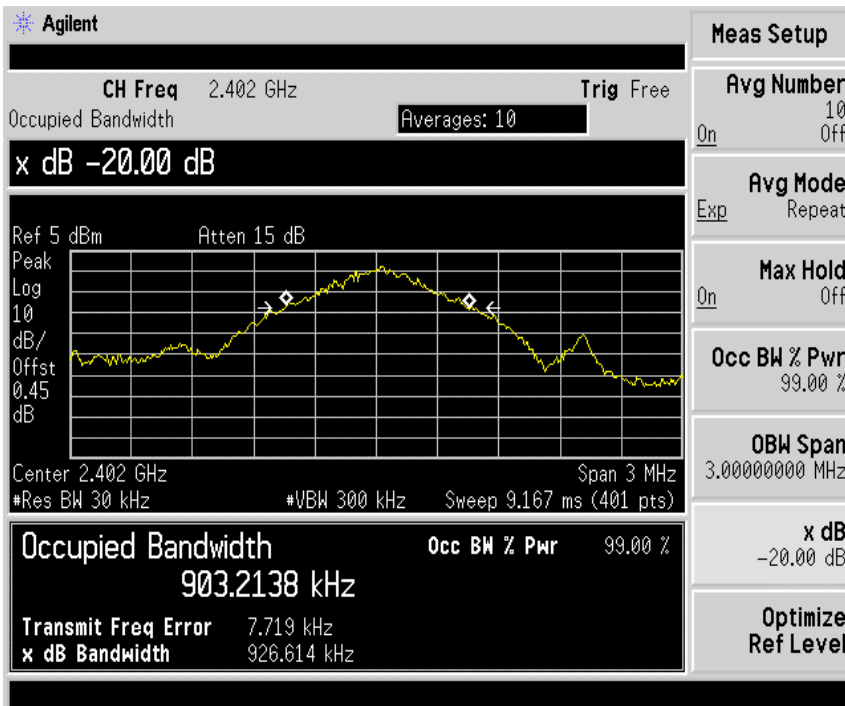
CHANNEL	Channel Frequency (MHz)	99% Occupied Bandwidth(MHz)	Remark
Inquiry mode	-	216.57	-



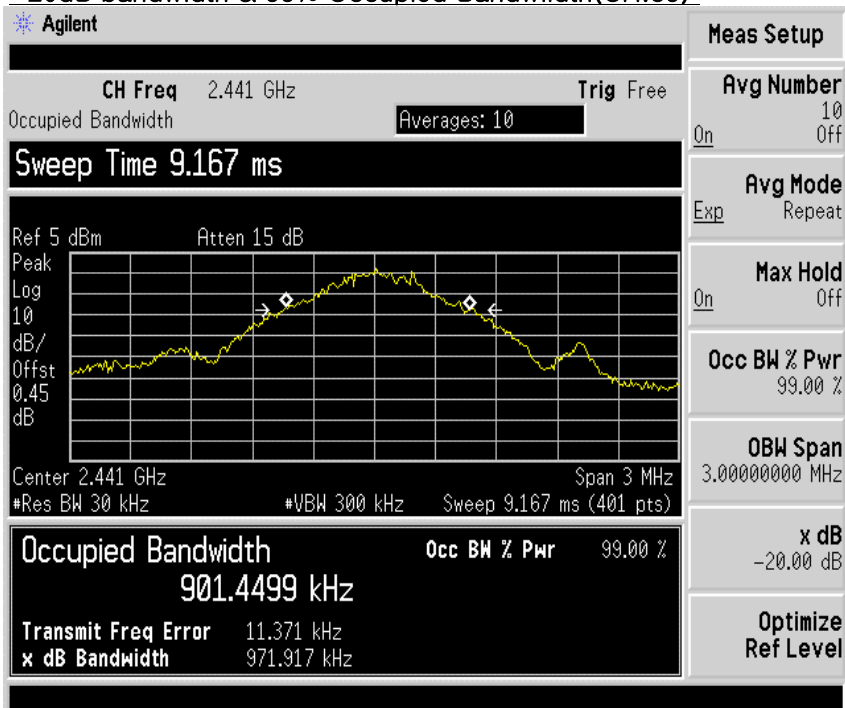
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5.4 Trace data

20dB bandwidth & 99% Occupied Bandwidth(CH.0)



20dB bandwidth & 99% Occupied Bandwidth(CH.39)

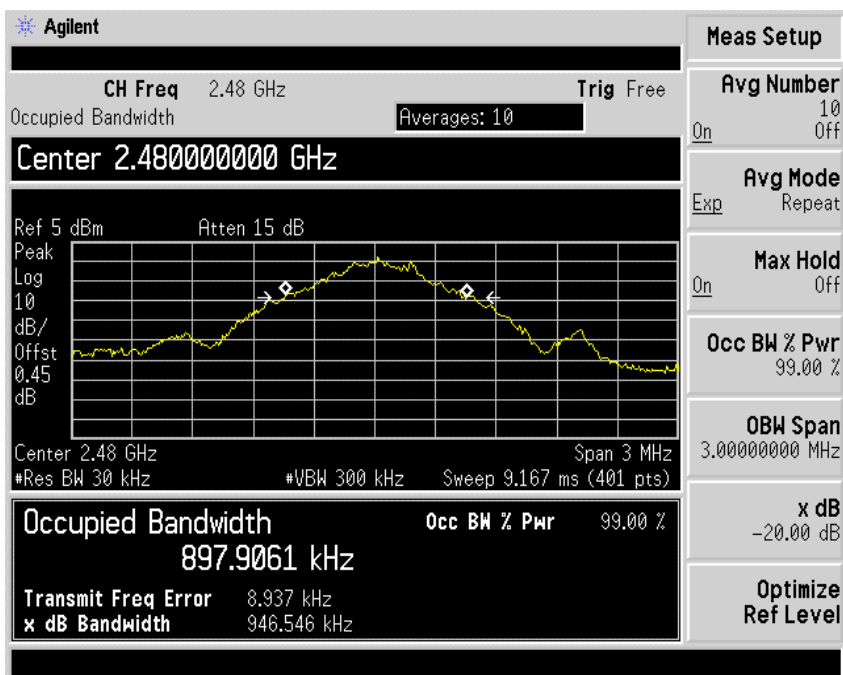




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5.4 Trace data

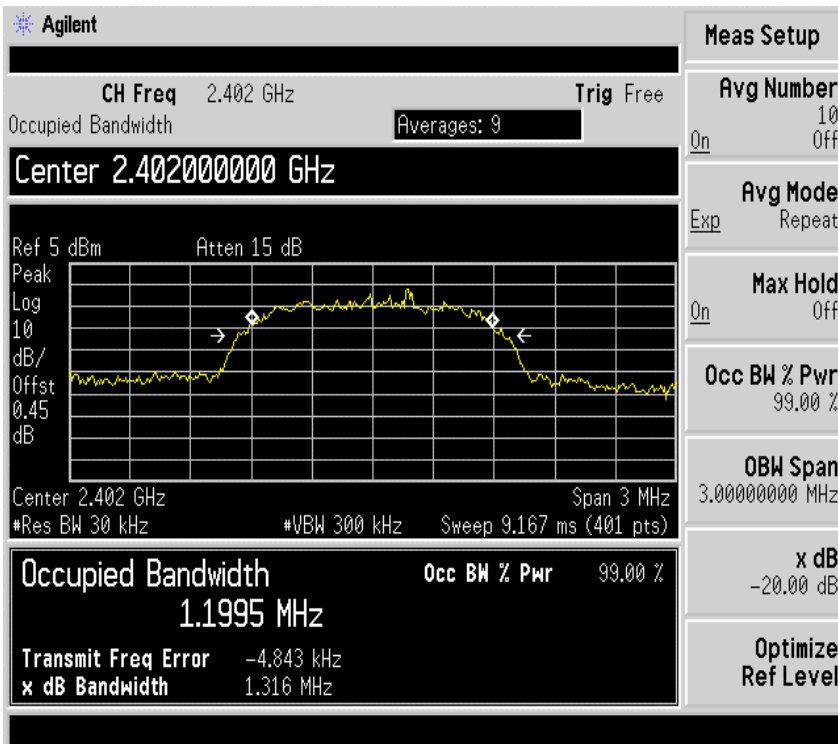
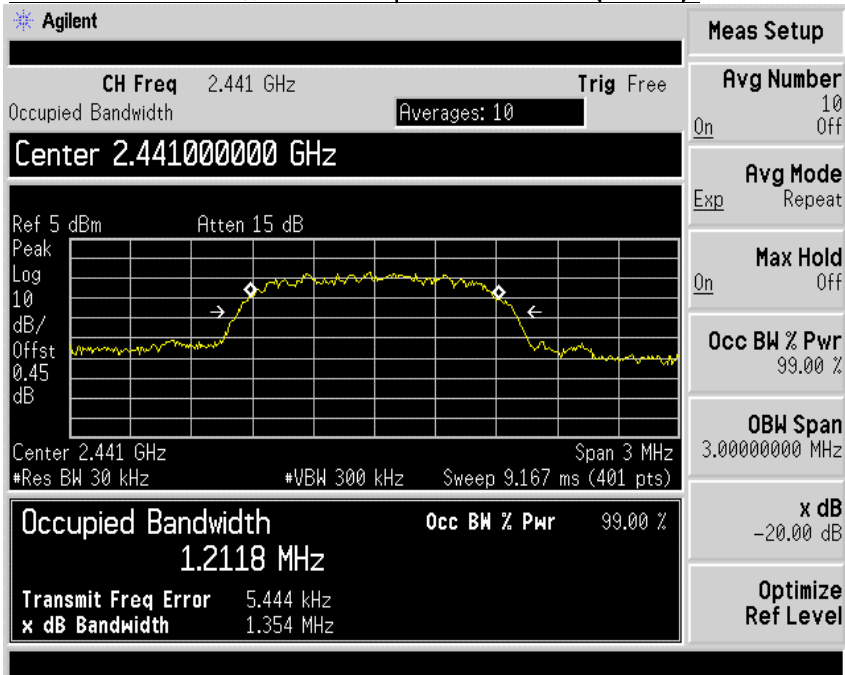
20dB bandwidth & 99% Occupied Bandwidth(CH.78)





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5.4 Trace data (EDR)

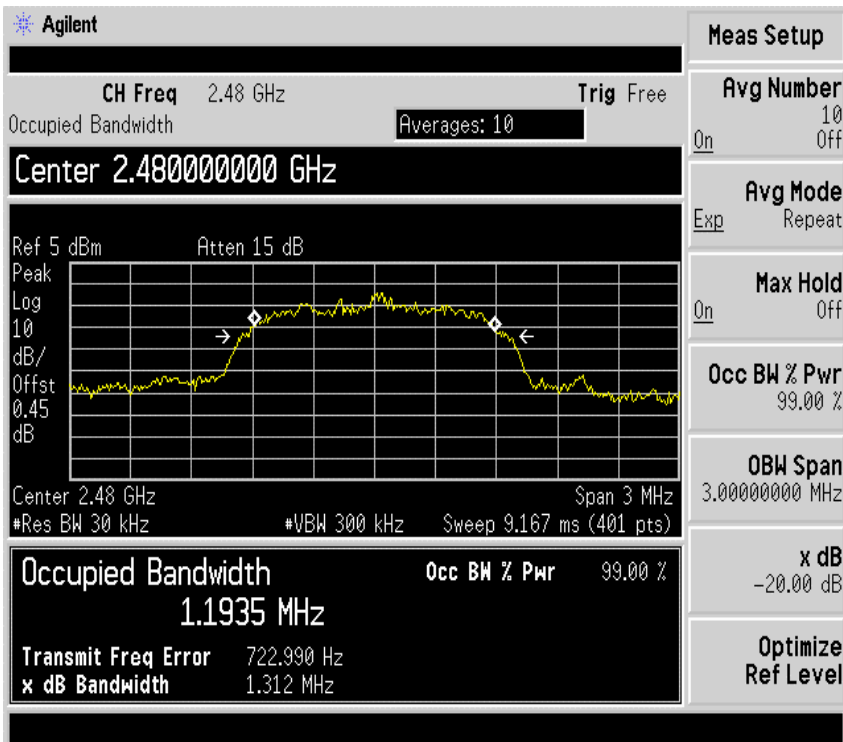
20dB bandwidth & 99% Occupied Bandwidth(CH.0)20dB bandwidth & 99% Occupied Bandwidth(CH.39)



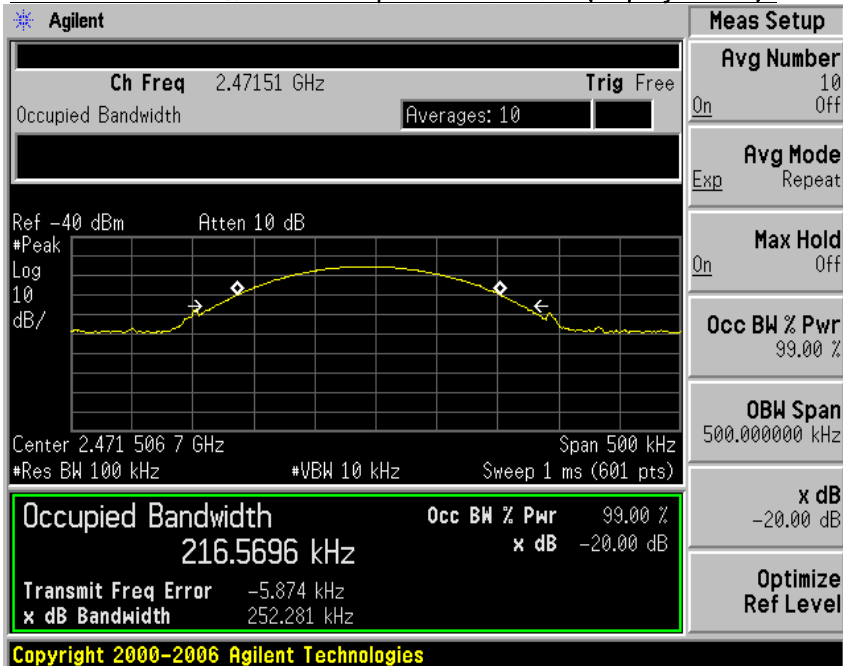
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5.4 Trace data (EDR)

20dB bandwidth & 99% Occupied Bandwidth(CH.78)



20dB bandwidth & 99% Occupied Bandwidth (Inquiry mode)

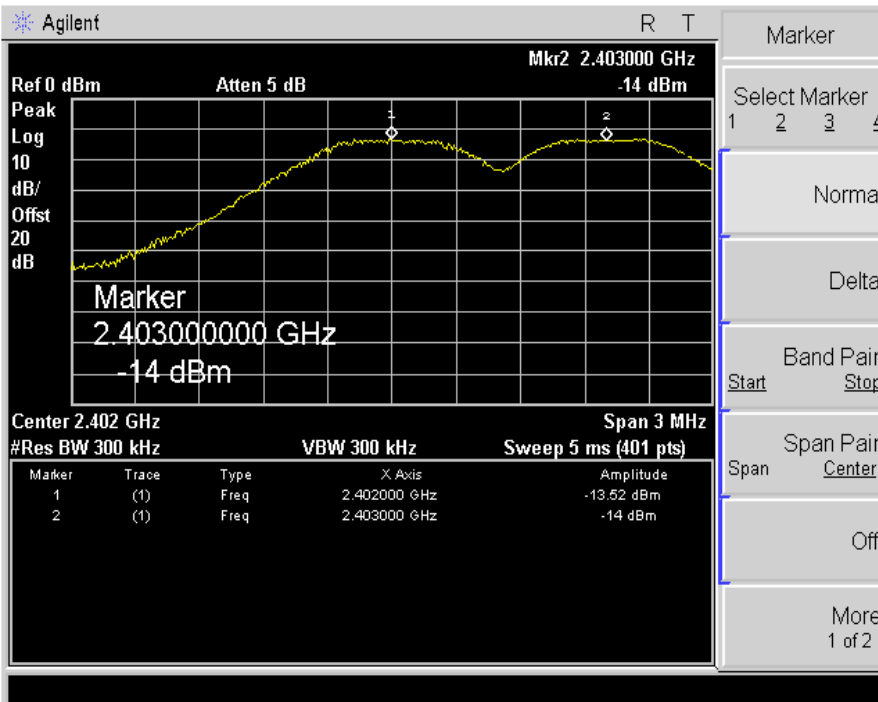




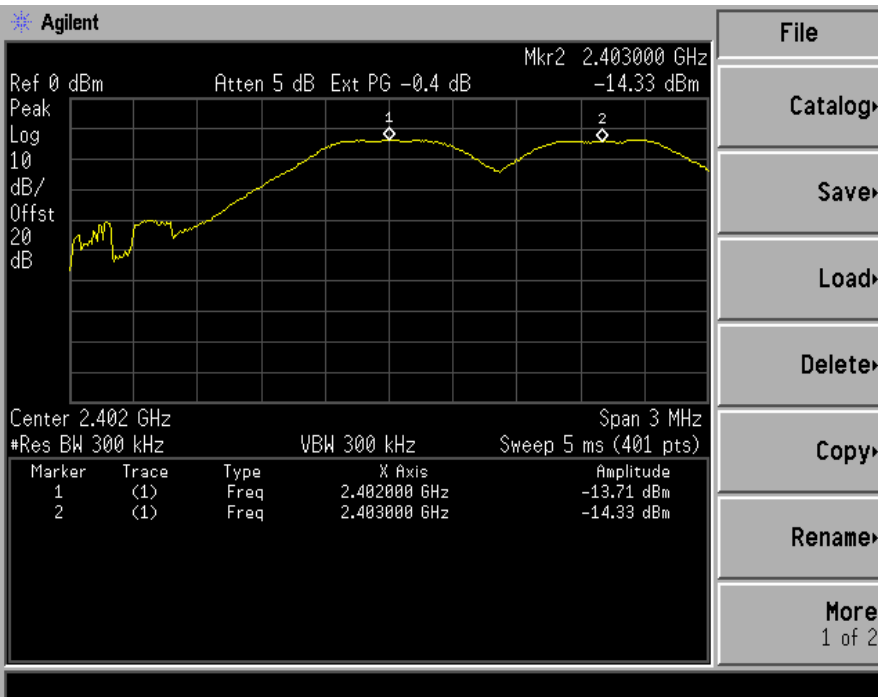
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5.4 Trace data

Channel Separation_BT (CH.0)



Channel Separation_EDR (CH.0)

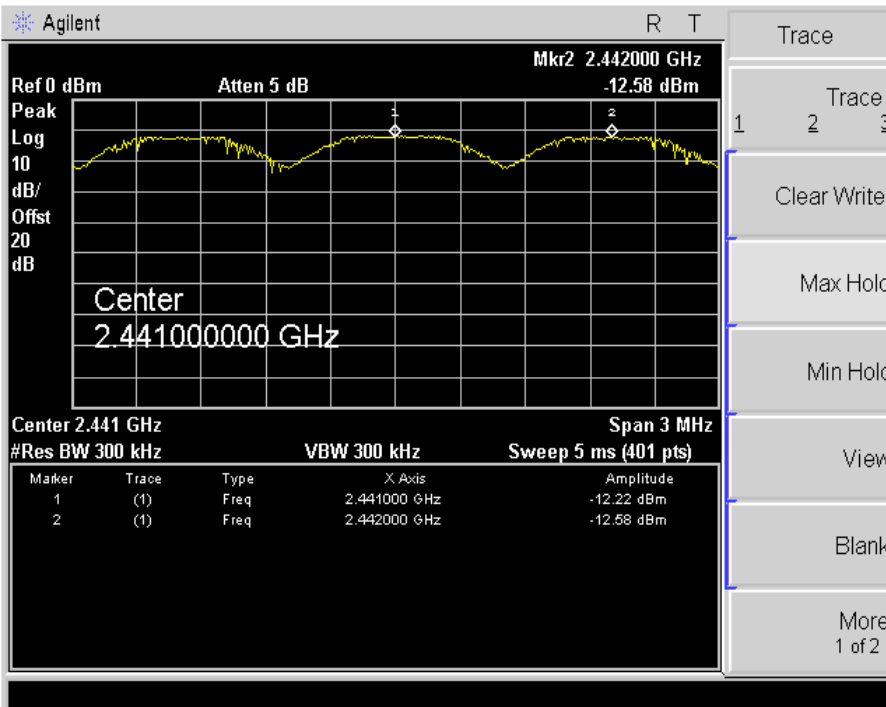




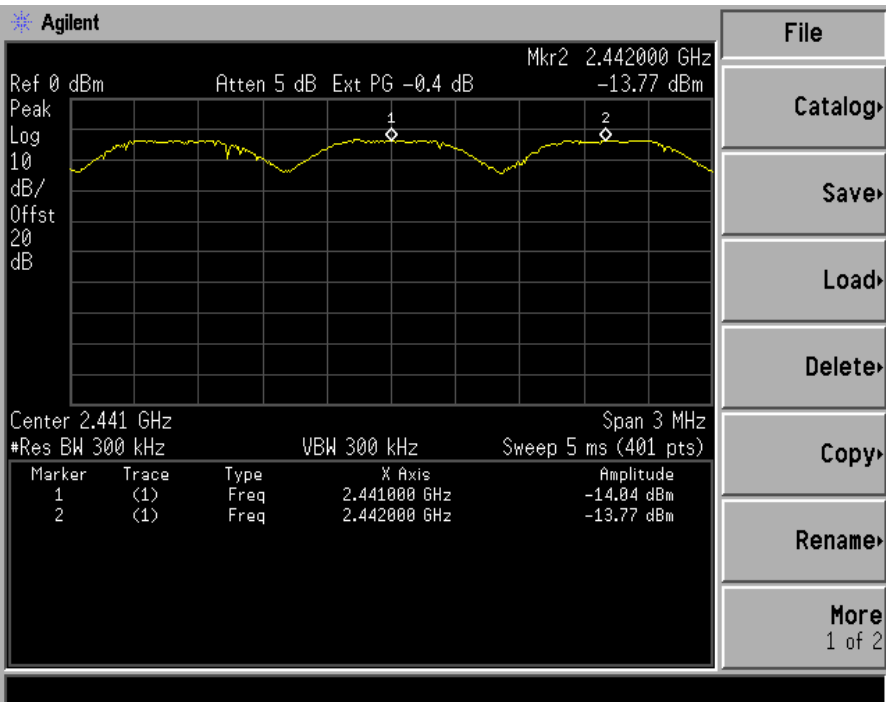
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5.4 Trace data

Channel Separation_BT (CH.39)



Channel Separation_EDR (CH.39)

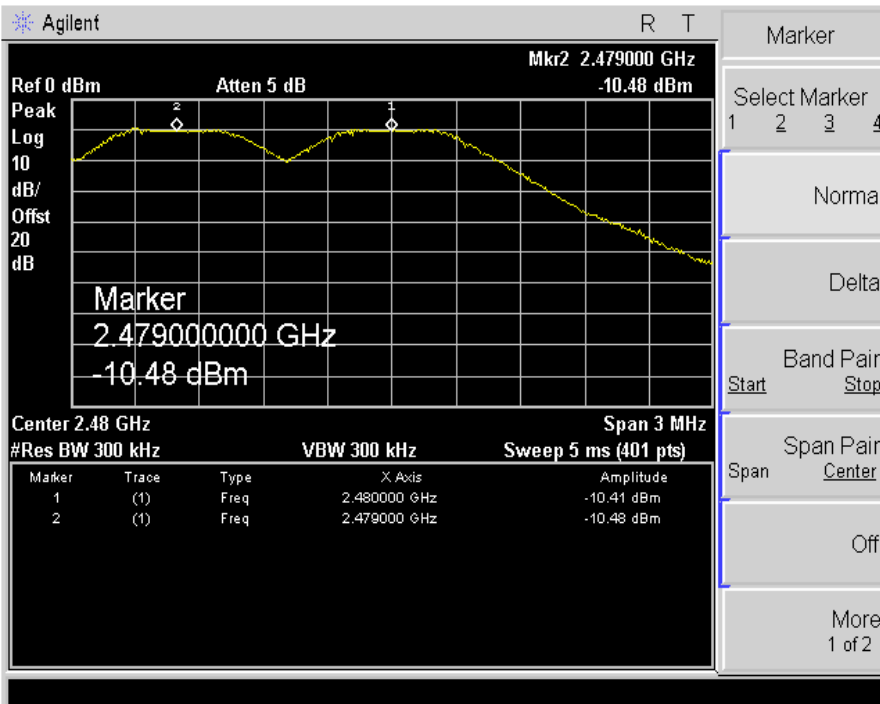




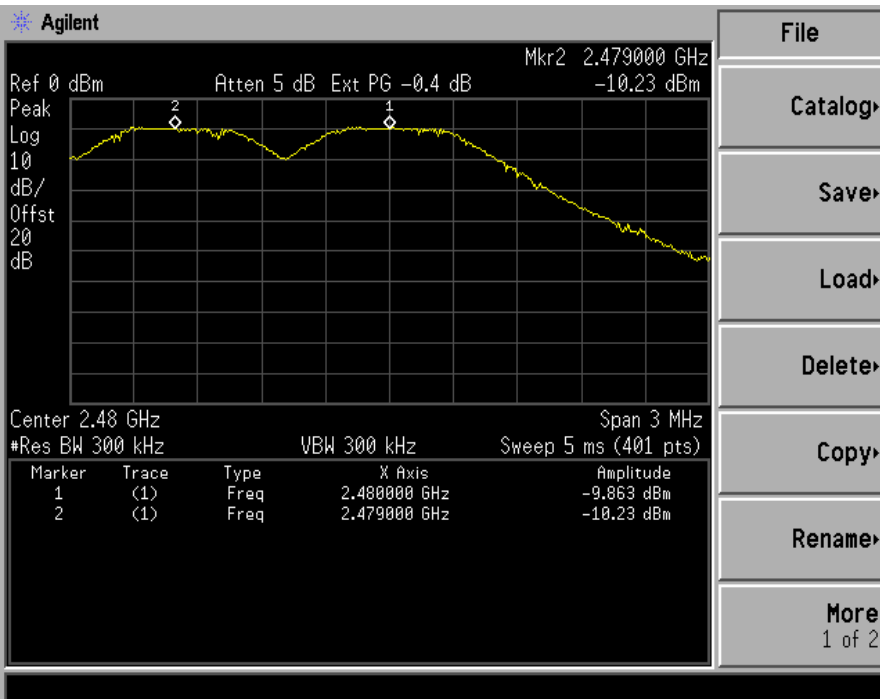
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5.4 Trace data

Channel Separation_BT (CH.78)



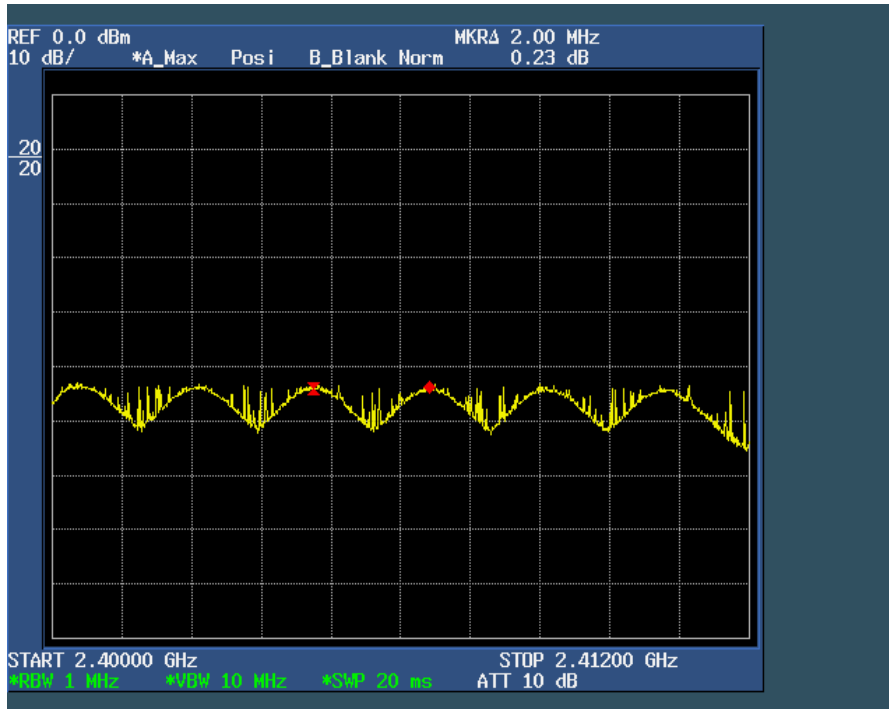
Channel Separation_EDR (CH.78)





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5.4 Trace data

Channel Separation_Inquiry Mode



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6. MAXIMUM PEAK OUTPUT POWER

6.1 Test procedure

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

The spectrum analyzer is set to as following.

. RBW= 1MHz . VBW= 1MHz . Span= 1MHz . Sweep= 1.6s

Description	Model	Serial Number	Cal. Due Date
Spectrum Analyzer	E4407B	US42041281	09/11/2009
Bluetooth Tester	TC-3000A	3000A570224	12/05/2009
Dual Directional Coupler	778D	16502	02/28/2009
-Spectrum Analyzer <=> EUT	Loss: 21.0dB	-	

6.2 Measurement results

EUT	Capsule Endoscope & Receiver	MODEL	MiroCam Capsule Endoscope System
MODE	GFSK, DH5	Environmental Condition	25℃, 43%RH
INPUT POWER	120Vac, 60Hz		

CHANNEL	Channel Frequency (MHz)	Peak Power Output(dBm)		Limit[1W] (dBm)	PASS/FAIL
		(dBm)	(W)		
0	2402	-2.00	0.0006	30.0	PASS
39	2441	-2.10	0.0006	30.0	PASS
78	2480	-2.88	0.0005	30.0	PASS

CHANNEL (EDR)	Channel Frequency (MHz)	Peak Power Output(dBm)		Limit[1W] (dBm)	PASS/FAIL
		(dBm)	(W)		
0	2402	-4.20	0.0004	30.0	PASS
39	2441	-4.28	0.0004	30.0	PASS
78	2480	-5.32	0.0003	30.0	PASS

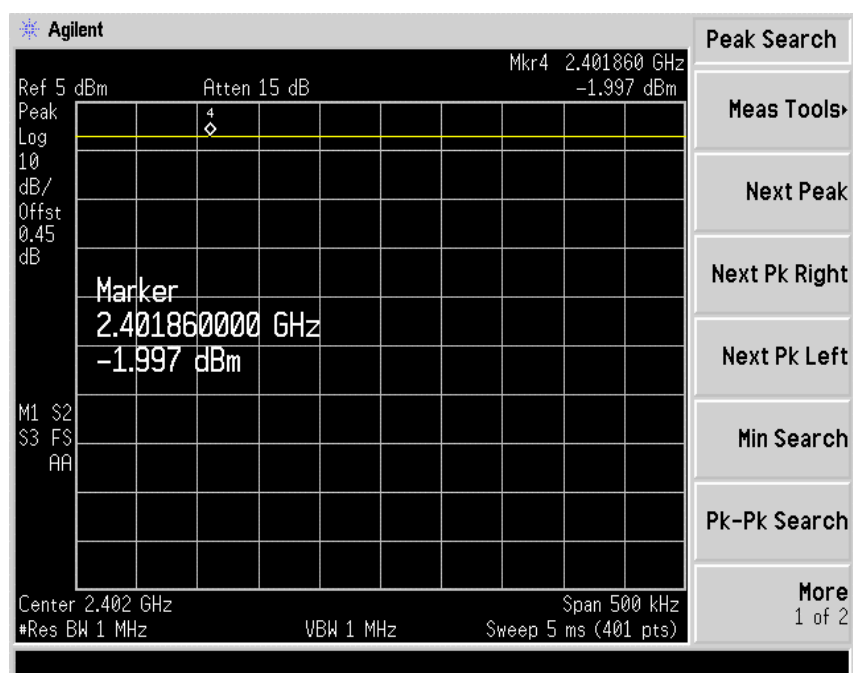
CHANNEL (Inquiry Mode)	Channel Frequency (MHz)	Peak Power Output(dBm)		Limit[1W] (dBm)	PASS/FAIL
		(dBm)	(W)		
0	2402	-53.29	0.0000	30.0	PASS



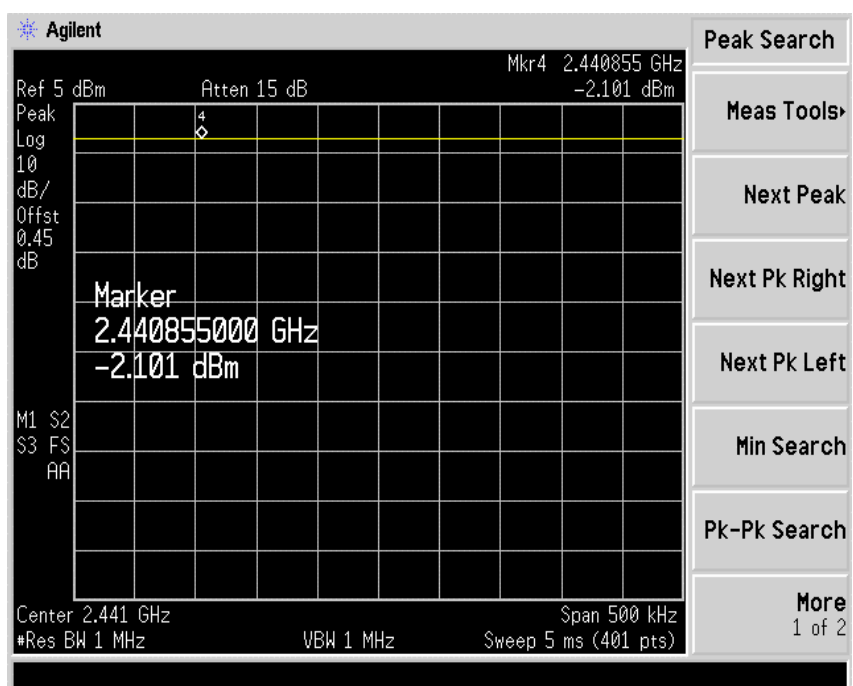
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6.3 data

CH0



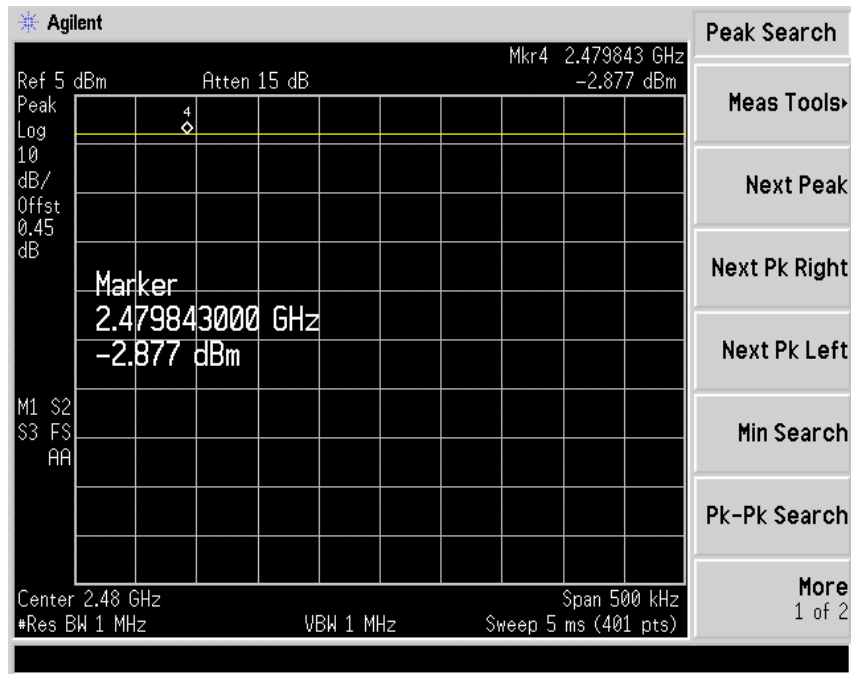
CH39





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CH78

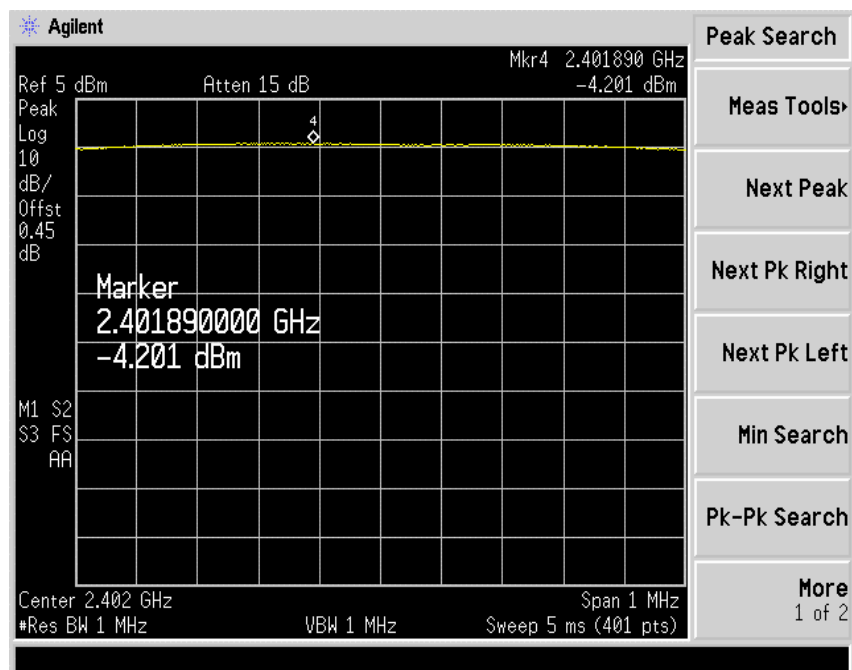




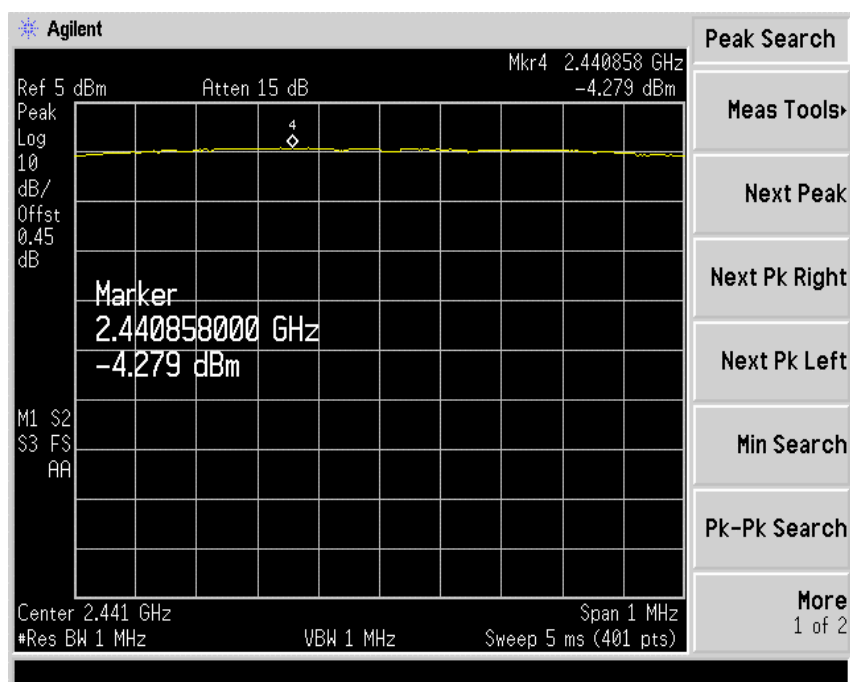
Underwriters Laboratories Inc.

EDR

CH0



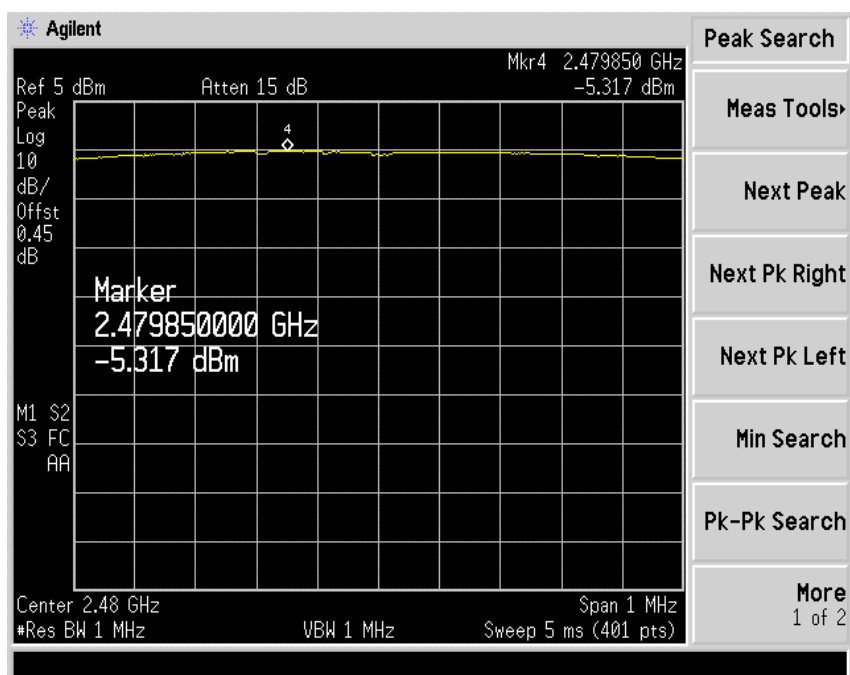
CH39



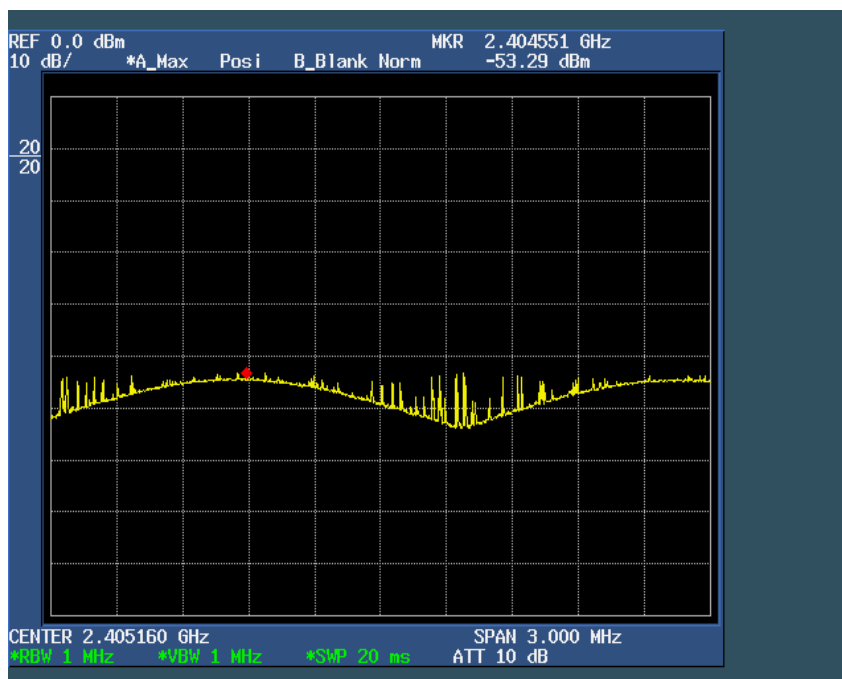


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CH78



Inquiry Mode





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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	E4407B	US42041281	09/11/2009
Bluetooth Tester	TC-3000A	3000A570224	12/05/2009
Dual Directional Coupler	778D	16502	02/28/2009
–Spectrum Analyzer <=> EUT	Loss: 21.0dB		

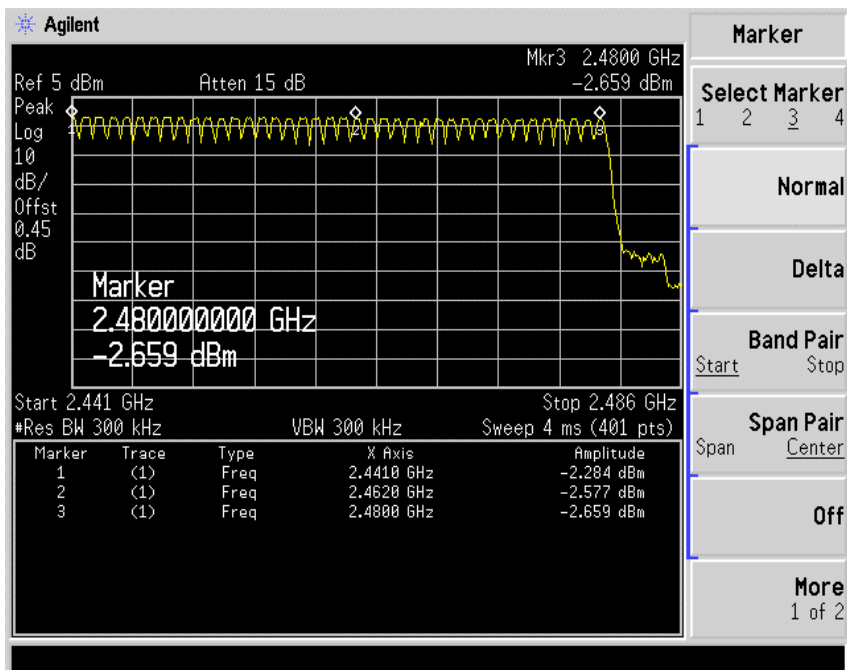
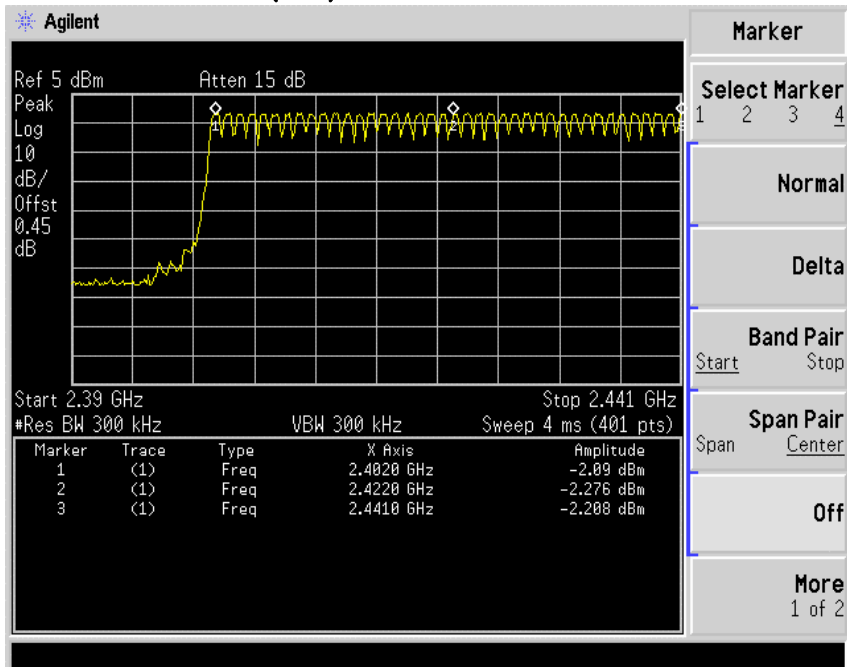
7.3 Measurement results

EUT	MiroCam Endoscope & Receiver	MODEL	MiroCam Endoscope System
MODE	FHSS	Environmental Condition	24℃, 43%RH
INPUT POWER	120Vac, 60Hz		
Mode	Number of CH	Limit (Number of CH)	PASS/FAIL
BT	79	>15	PASS
EDR	79	>15	PASS
Inquiry	32	>15	PASS



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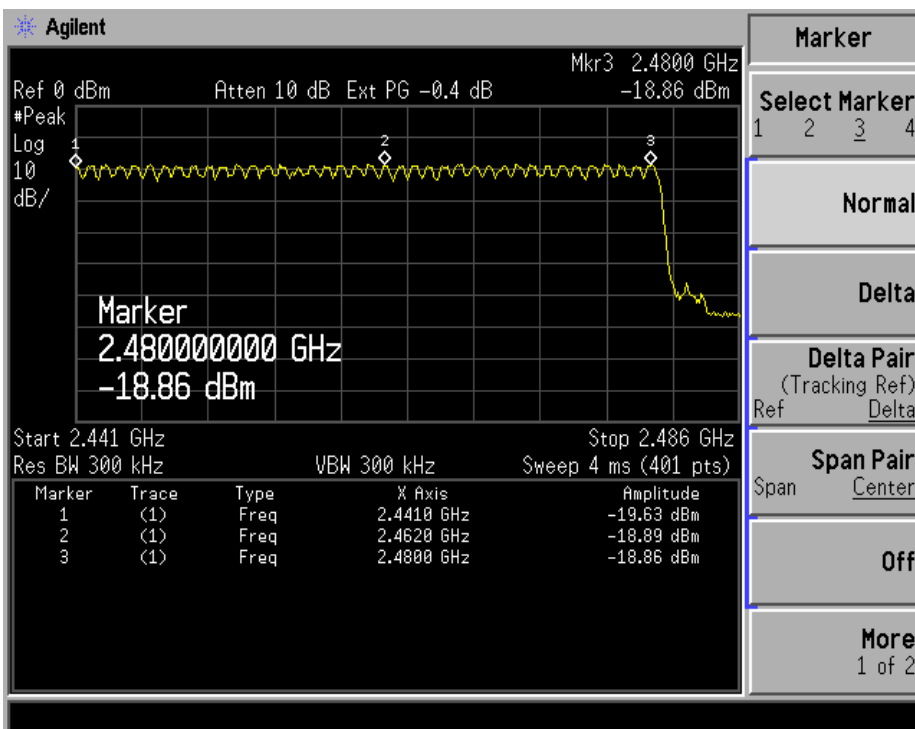
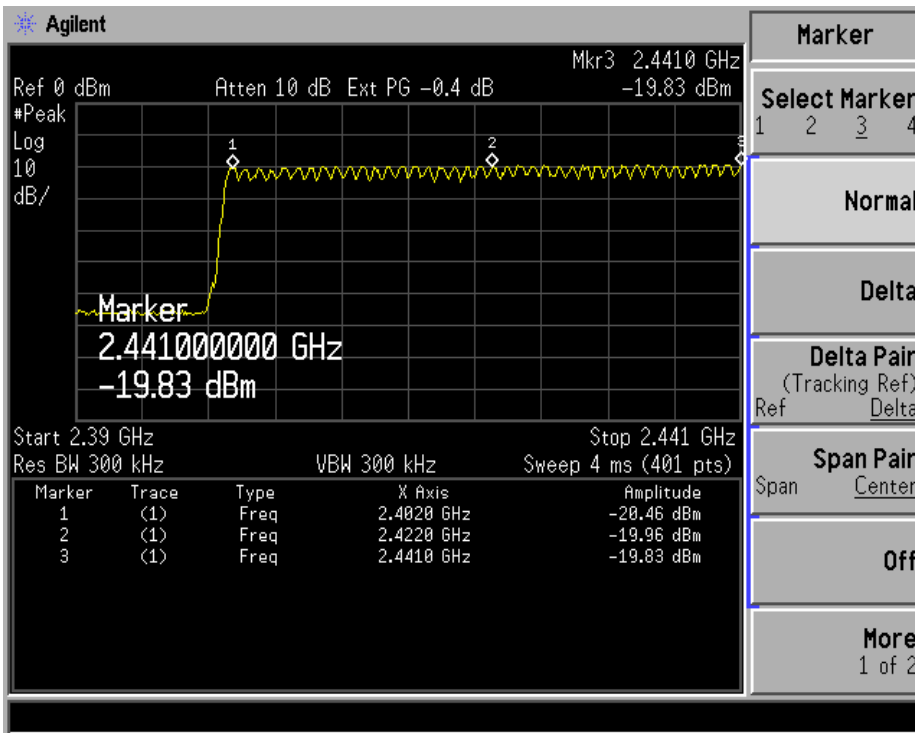
7.4 Trace data(BT)





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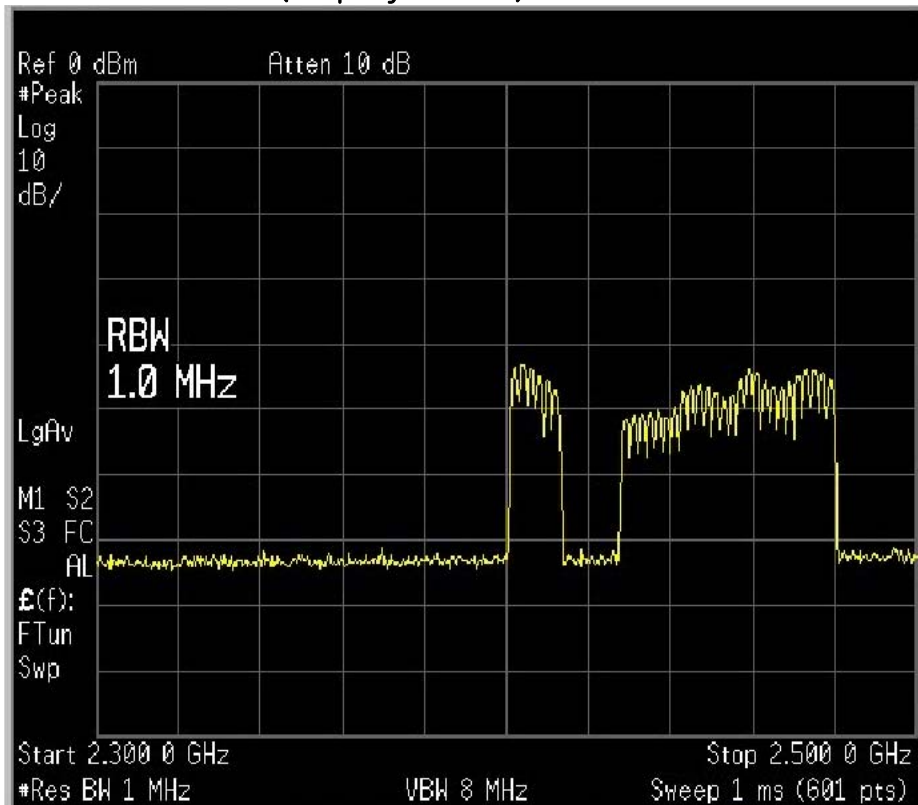
7.5 Trace data (EDR)_2Mbps





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7.6 Trace data (Inquiry Mode)





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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 hopping channel
- . Sweep = as necessary to capture the entire dwell time per hopping channel
- . Detector function = Peak
- . Trace = Max hold

The Time of Occupancy Test Instruments

Description	Model	Serial Number	Cal. Due Date
Spectrum Analyzer	E4407B	US42041281	09/11/2009
Bluetooth Tester	TC-3000A	3000A570224	12/05/2009
Dual Directional Coupler	778D	16502	02/28/2009
-Spectrum Analyzer <=> EUT	Loss: 21.0dB	–	

8.3 Measurement results

EUT	MiroCam Endoscope & Receiver	MODEL	MiroCam Endoscope System
MODE	FHSS	Environmental Condition	24℃, 43%RH
INPUT POWER	120Vac, 60Hz		



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8.4 Measurement Data

****Calculation Method**

The system makes worst case 1 600 hops per second or 1 time slot has a length of $625\mu s$ with 79 channels.

A DH1 Packet need 1 time slot for transmitting and 1 time slot for receiving. Then the system makes worst case $1600/2 = 800$ hops per second with 79 channels. So you have each channel $800/79 = 10.13$ times per a second.

A total time of occupancy is get by multiplying the measured number of transmissions occurred for a second and a period of $0.4 \times 79 = 31.6$ seconds.

You have $10.13 \times 31.6 = 320.11$ times of appearance.

Dwell time = time slot \times hop rate / number of hopping channels $\times 31.6$ s

DH 1 time slot = time slot $\times (1600/2) / 79 \times 31.6$ s

DH 3 time slot = time slot $\times (1600/4) / 79 \times 31.6$ s

DH 5 time slot = time slot $\times (1600/6) / 79 \times 31.6$ s

Inquiry mode Dwell time = time slot $\times 100/32 \times (0.4 \times 32)$



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8.4 Measurement Data

A. DH1 Mode

One period for each particular channel : $0.435 \text{ ms} \times 320.1 = 139.2435 \text{ ms}$

Channel	Pulse Duration(ms)	Dwell Time(ms)	Limit (ms)	PASS/FAIL
39	0.435	139.240	400	PASS

B. DH3 Mode

One period for each particular channel : $1.768 \text{ ms} \times 159.9 = 282.703 \text{ ms}$

Channel	Pulse Duration(ms)	Dwell Time(ms)	Limit (ms)	PASS/FAIL
39	1.768	282.700	400	PASS

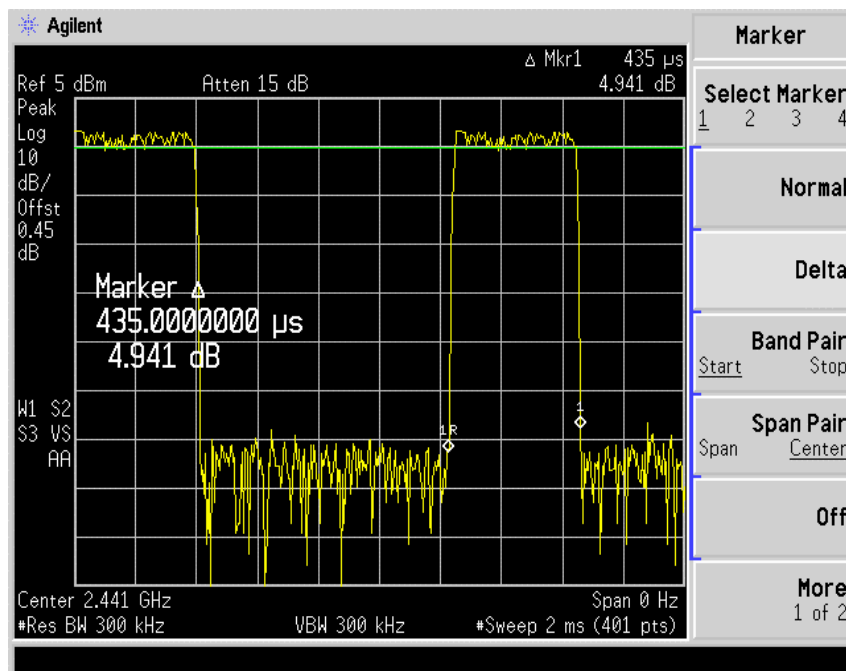
C. DH5 Mode

One period for each particular channel : $2.881 \text{ ms} \times 106.81 = 307.7196 \text{ ms}$

Channel	Pulse Duration(ms)	Dwell Time(ms)	Limit (ms)	PASS/FAIL
39	2.881	307.720	400	PASS

8.5 Trace data(BT)

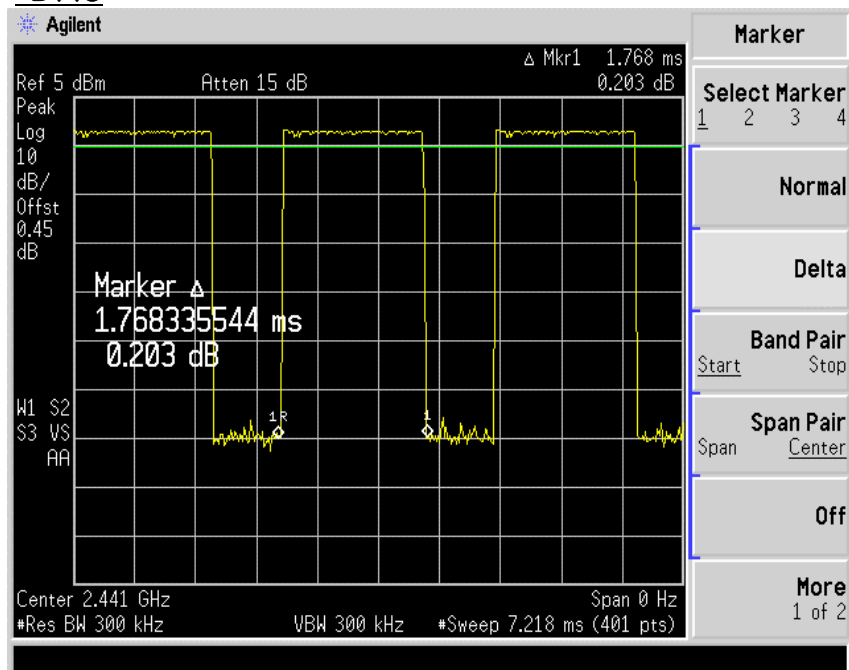
DH1



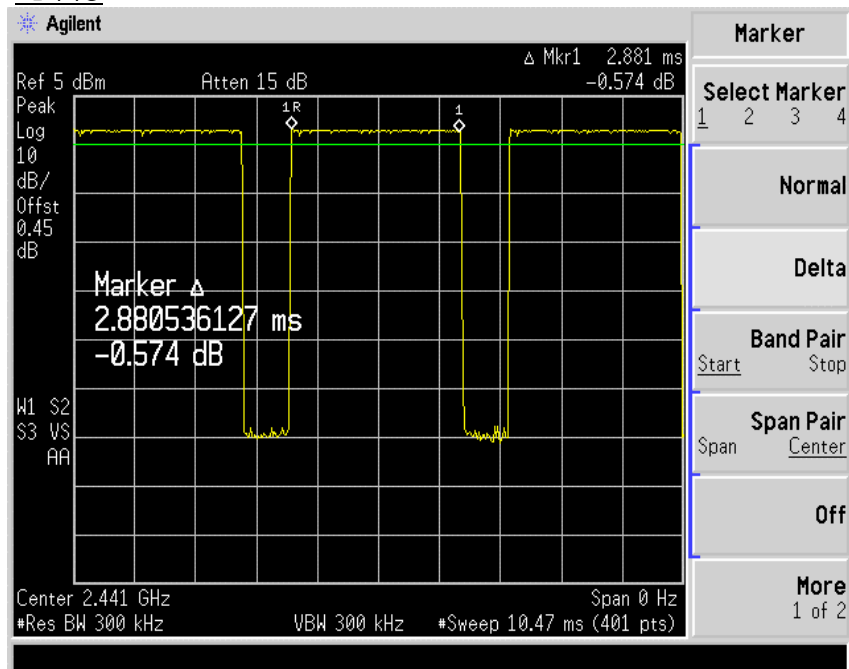


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DH3



DH5





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8.6 Measurement Data(EDR)

319.04147

A. DH1 Mode

One period for each particular channel : $0.442 \text{ ms} \times 320.1 = 150.447 \text{ ms}$

Channel	Pulse Duration(ms)	Dwell Time(ms)	Limit (ms)	PASS/FAIL
39	0.47	150.447	400	PASS

B. DH3 Mode

One period for each particular channel : $1.739 \text{ ms} \times 159.9 = 287.066 \text{ ms}$

Channel	Pulse Duration(ms)	Dwell Time(ms)	Limit (ms)	PASS/FAIL
39	1.739	287.066	400	PASS

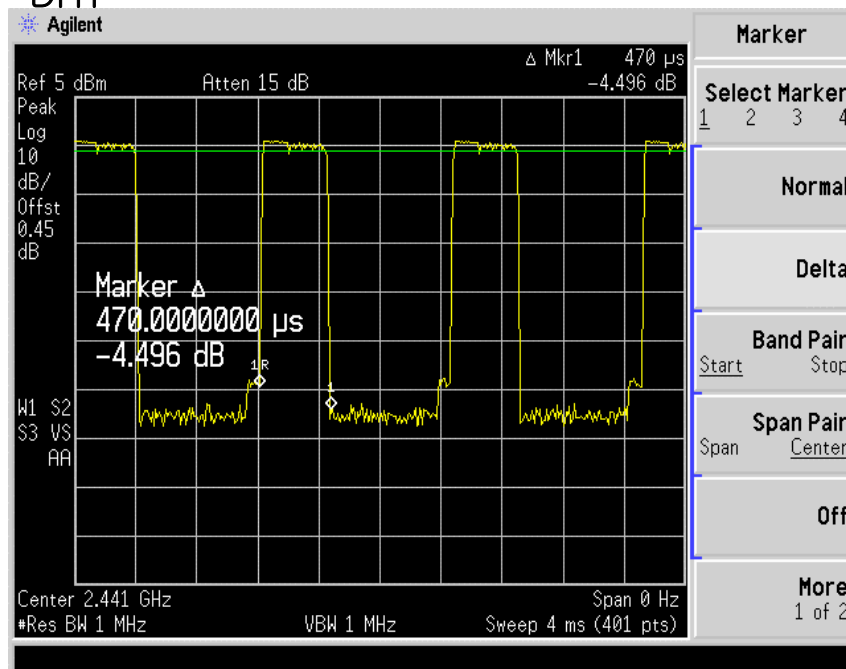
C. DH5 Mode

One period for each particular channel : $2.987 \text{ ms} \times 106.81 = 320.43 \text{ ms}$

Channel	Pulse Duration(ms)	Dwell Time(ms)	Limit (ms)	PASS/FAIL
39	2.987	319.041	400	PASS

8.7 Trace data(EDR)

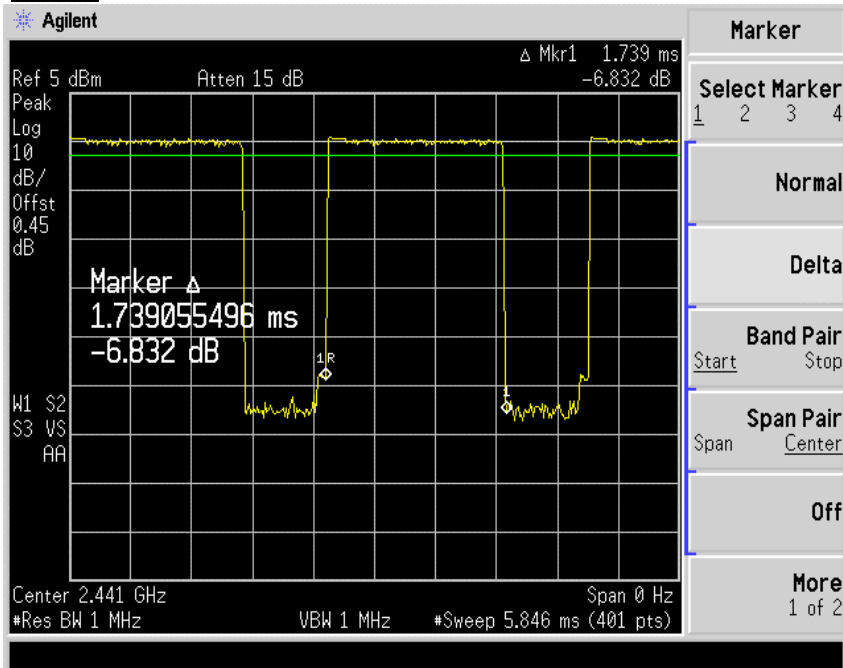
DH1



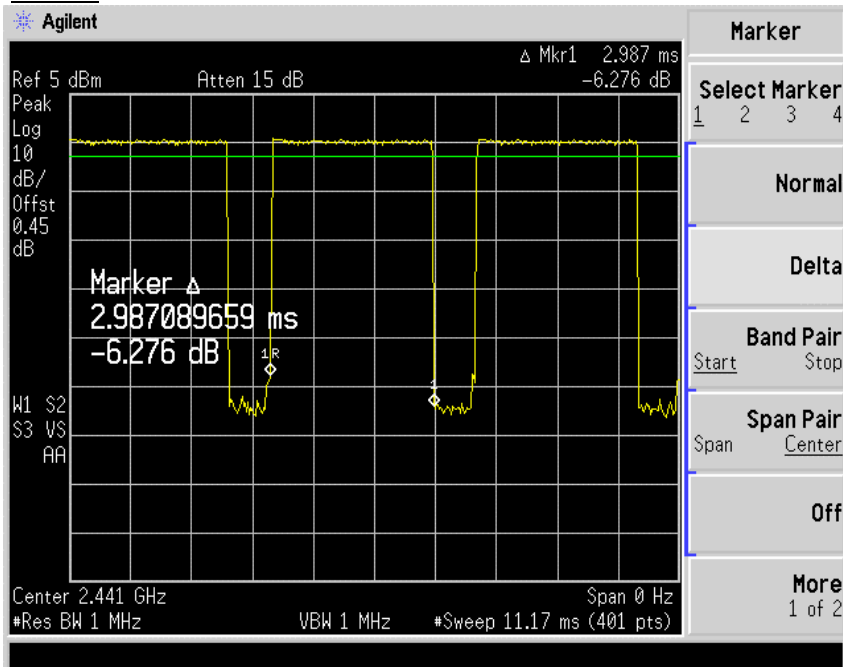


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DH3



DH5





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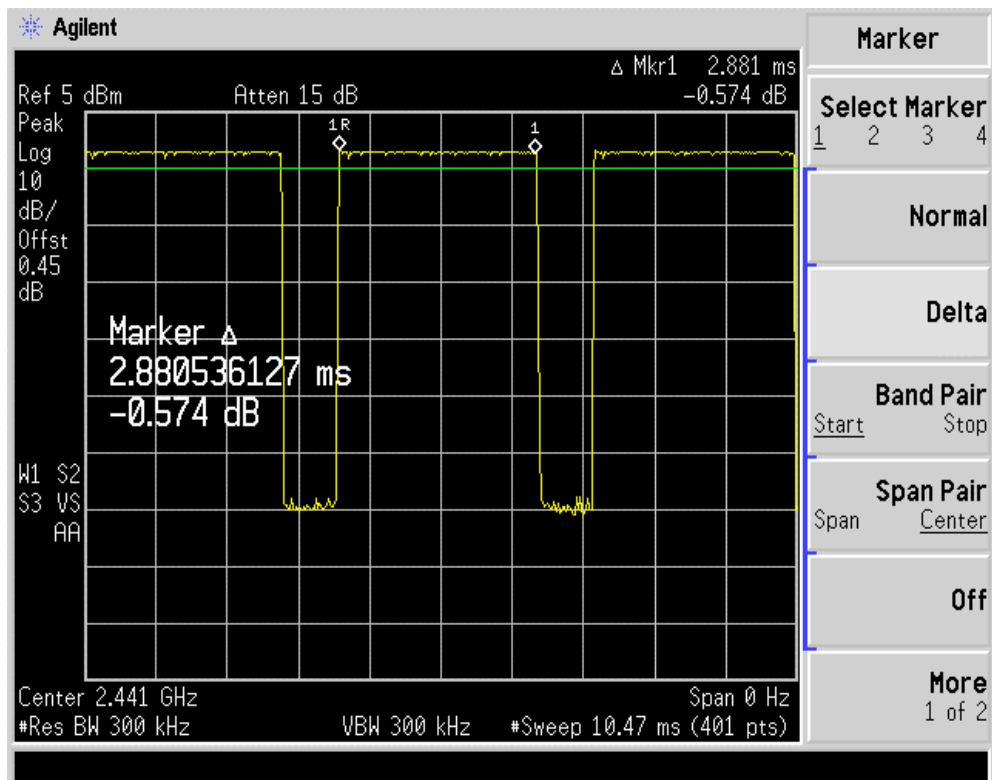
8.8 Measurement Data(Inquiry Mode)

A. Inquiry Mode

One period for each particular channel : $2.88 \text{ ms} \times 100/32 \times (0.4 \times 32) = 115.2 \text{ ms}$

Channel	Pulse Duration(ms)	Dwell Time(ms)	Limit (ms)	PASS/FAIL
-	2.88	115.200	400	PASS

8.9 Trace data





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9. band-edge and out of band emissions.

9.1 Test procedure

The radio frequency 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 em

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	E4407B	US42041281	09/11/2009
Bluetooth Tester	TC-3000A	3000A570224	12/05/2009
Dual Directional Coupler	778D	16502	02/28/2009
-Spectrum Analyzer <=> EUT	Loss: 21.0dB		

9.3 Measurement results of band-edge & out of emission

EUT	MiroCam Endoscope & Receiver	MODEL	MiroCam Endoscope System
MODE	GFSK	ENVIRONMENTAL CONDITION	25℃, 43%RH
INPUT POWER	120Vac, 60Hz		

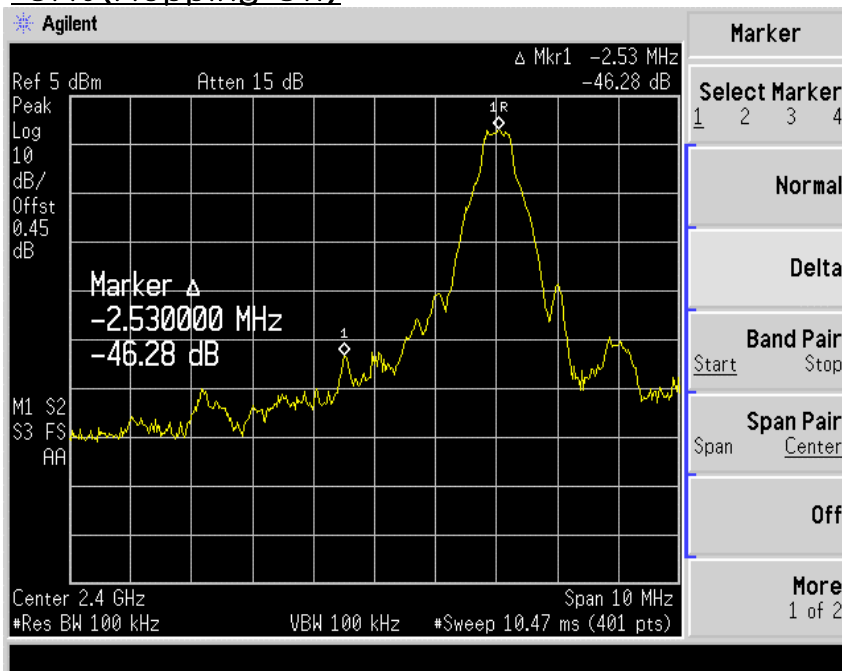
* Refer to attach spectrum analyzer data chart.



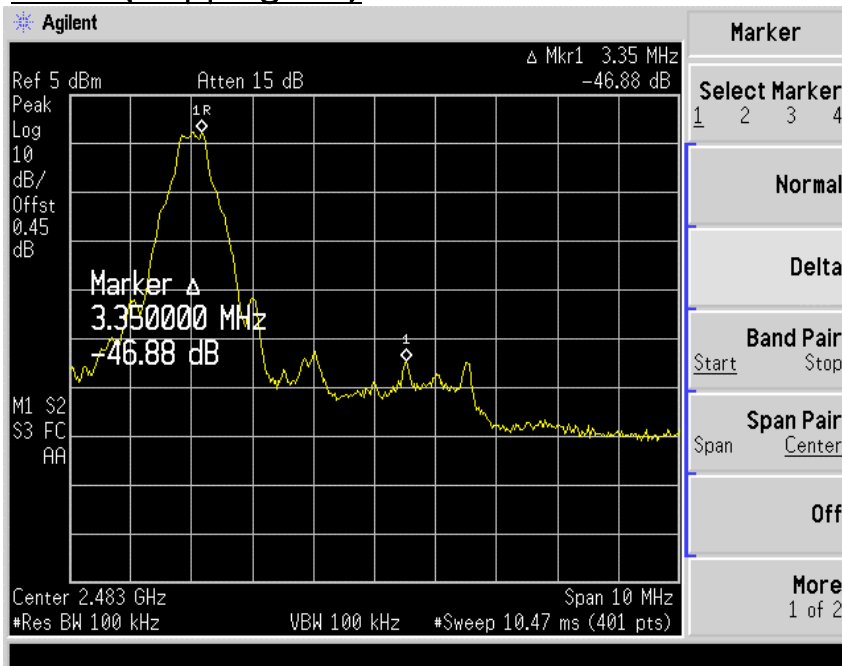
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9.4 Trace data of band-edge & Out of Emission band-edge

CH0(Hopping Off)



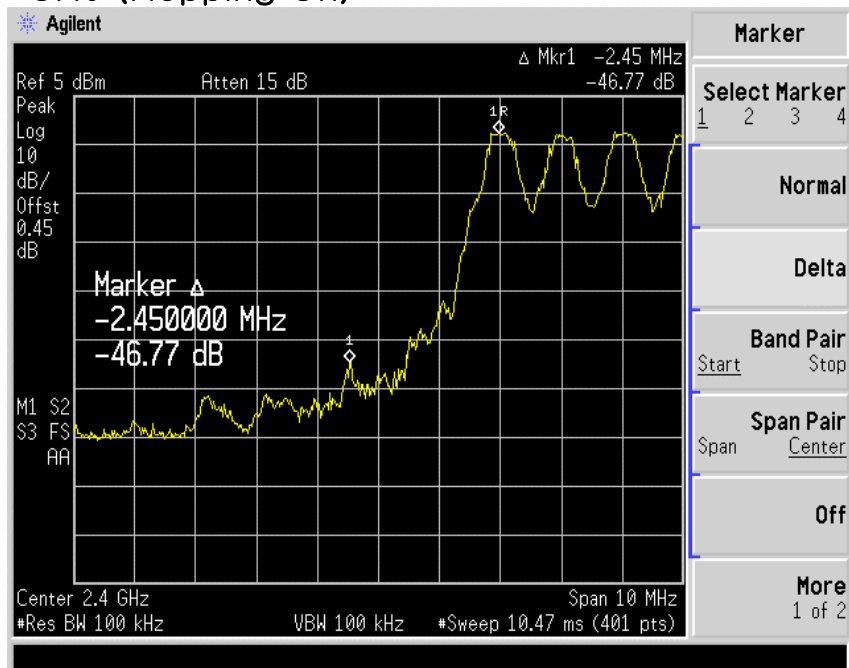
CH78(Hopping Off)



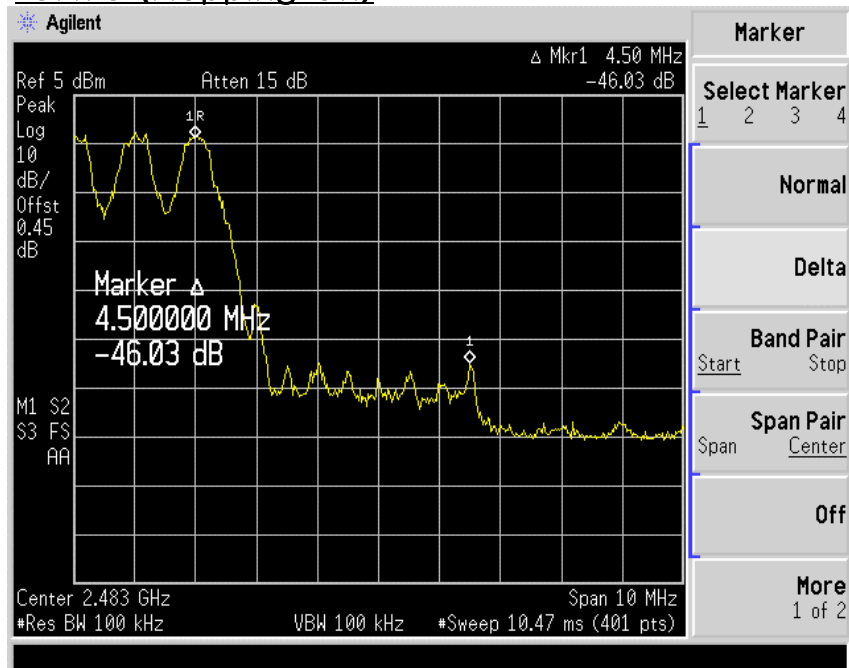


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band-edge CH0 (Hopping On)



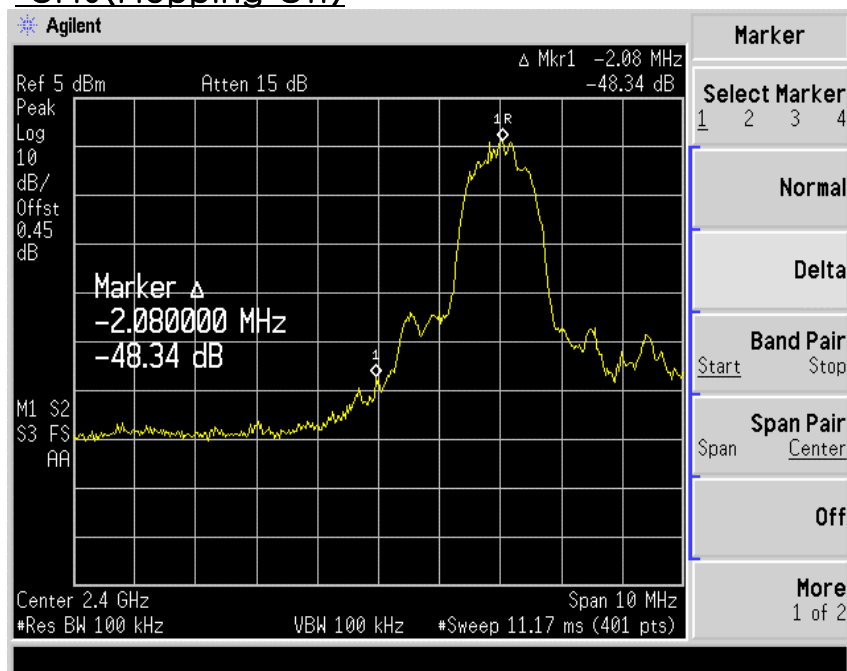
CH78 (Hopping On)



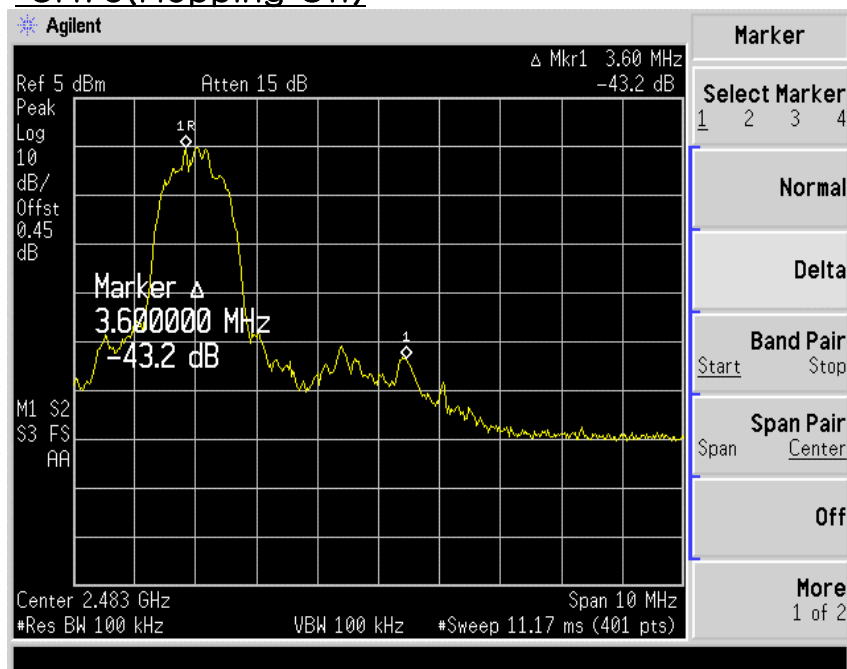


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band-edge(EDR) CH0(Hopping Off)



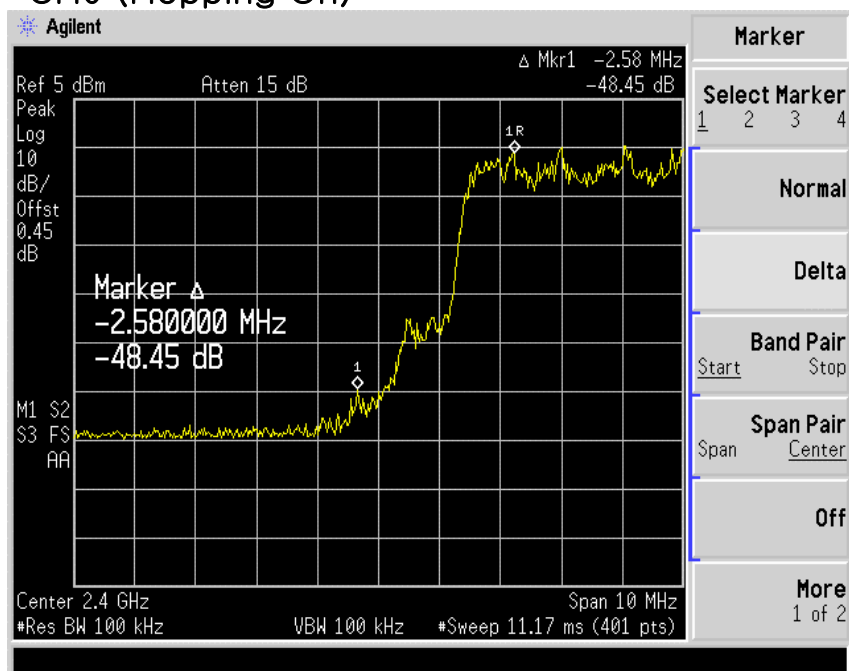
CH78(Hopping Off)



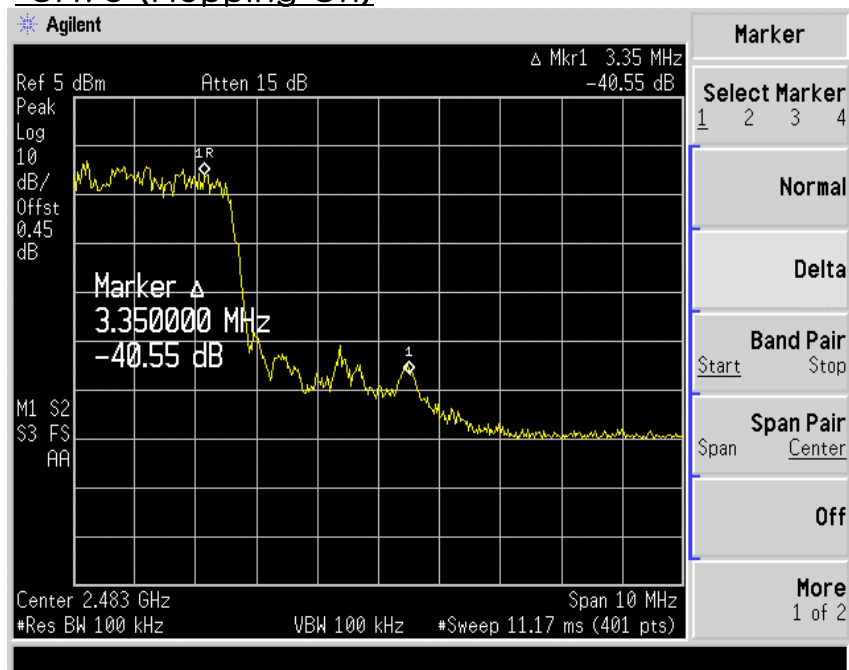


Underwriters Laboratories Inc.

band-edge(EDR) CH0 (Hopping On)



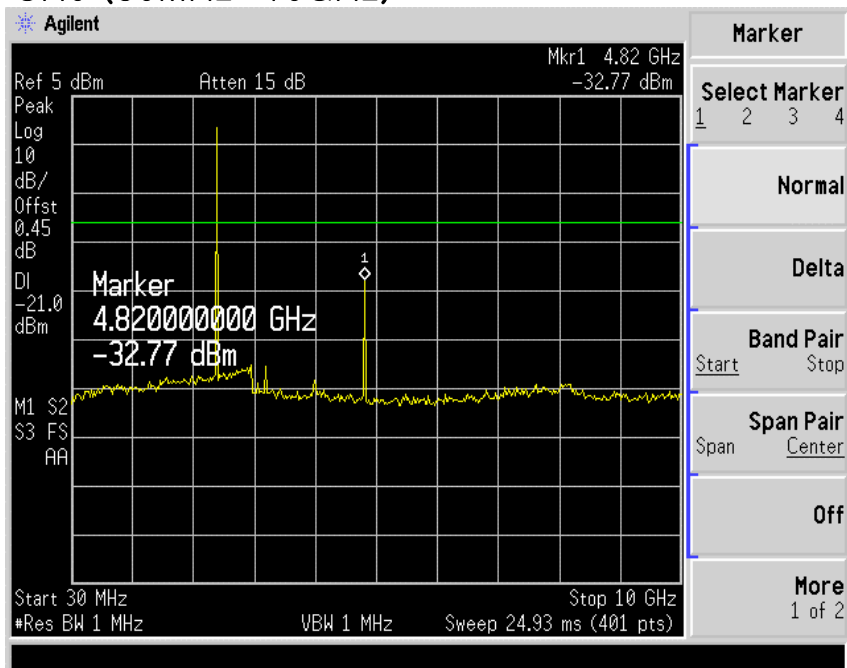
CH78 (Hopping On)



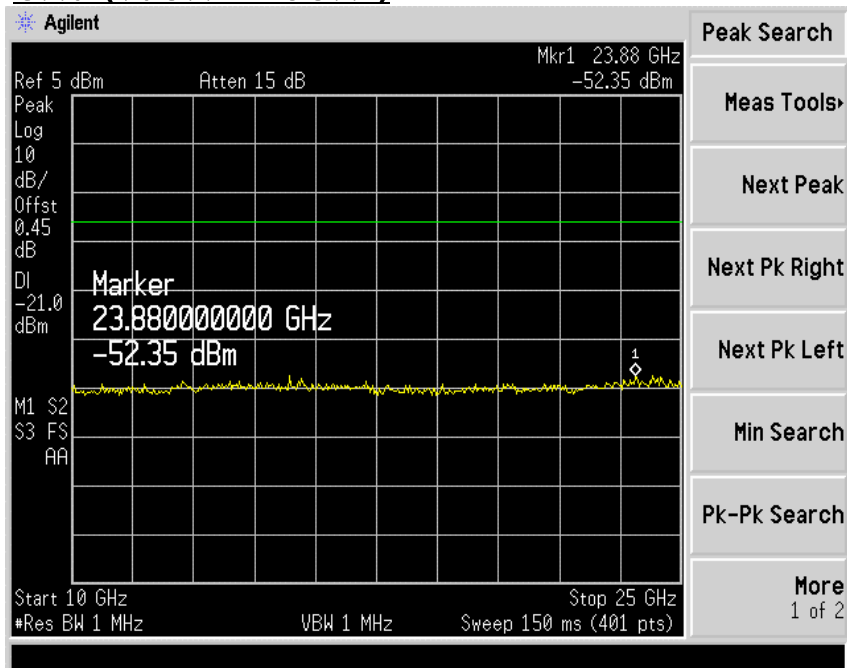


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Out of Band Emissions CH0 (30MHz~10GHz)



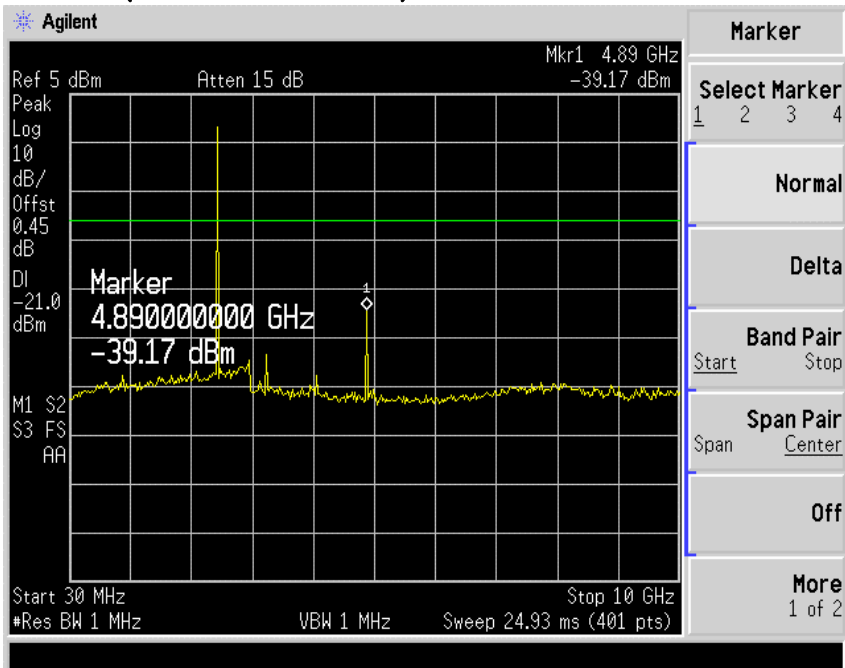
CH0 (10GHz~25GHz)



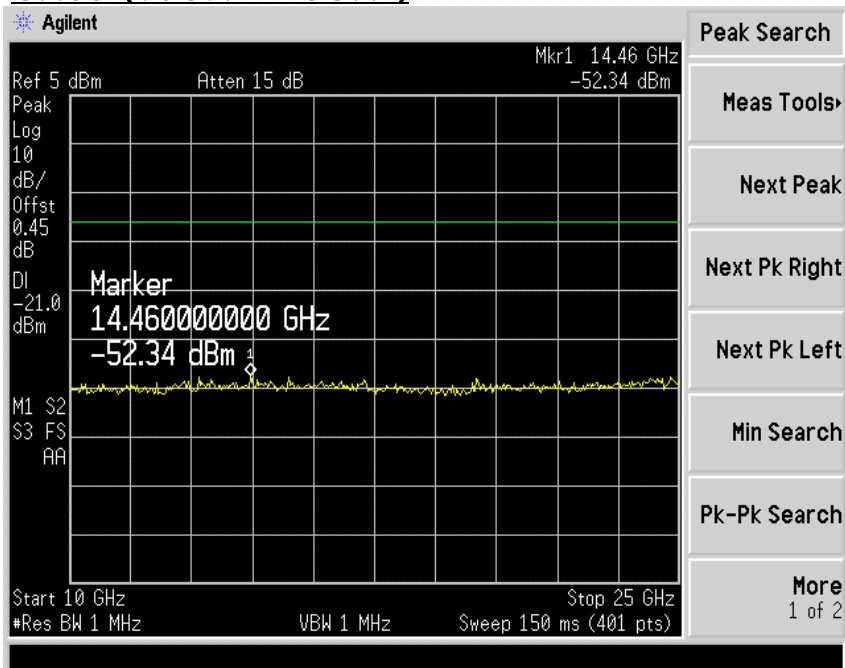


Underwriters Laboratories Inc.

Out of Band Emissions CH39 (30MHz~10GHz)



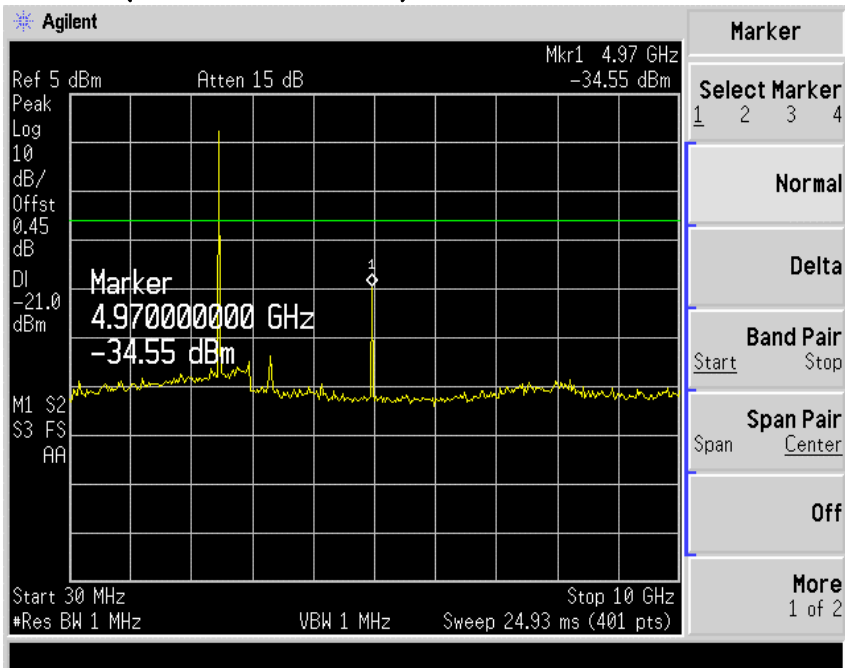
CH39 (10GHz~25GHz)



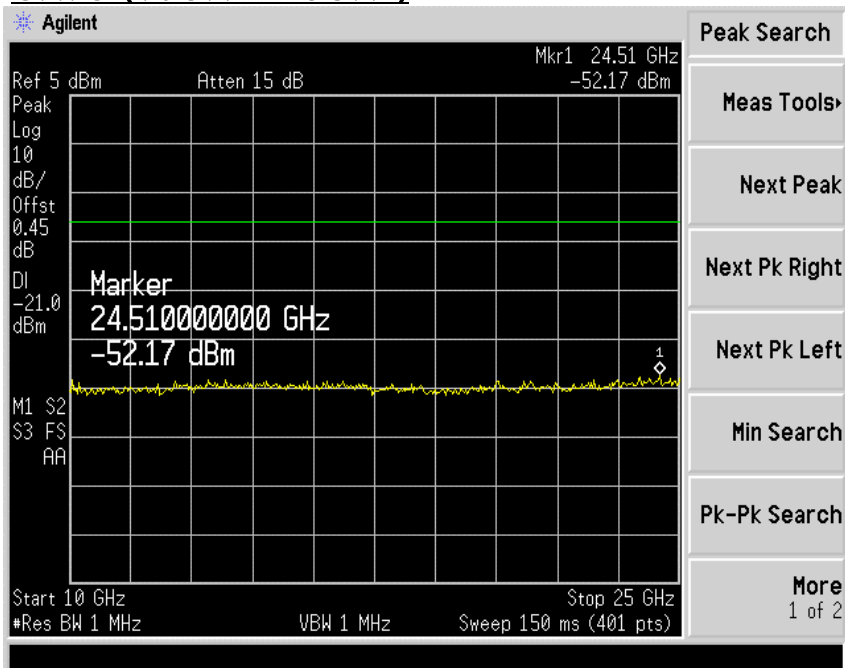


Underwriters Laboratories Inc.

Out of Band Emissions CH78 (30MHz~10GHz)



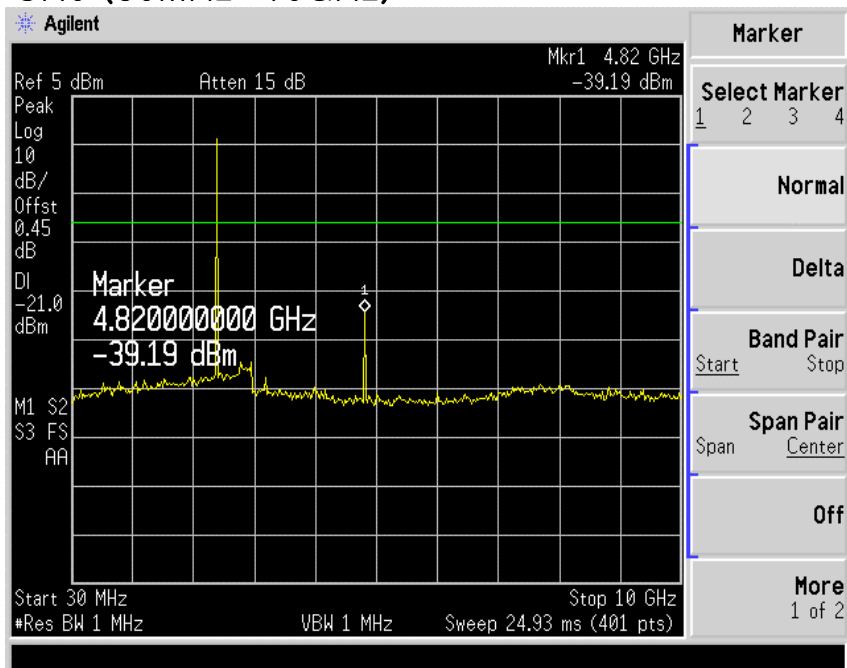
CH78 (10GHz~25GHz)



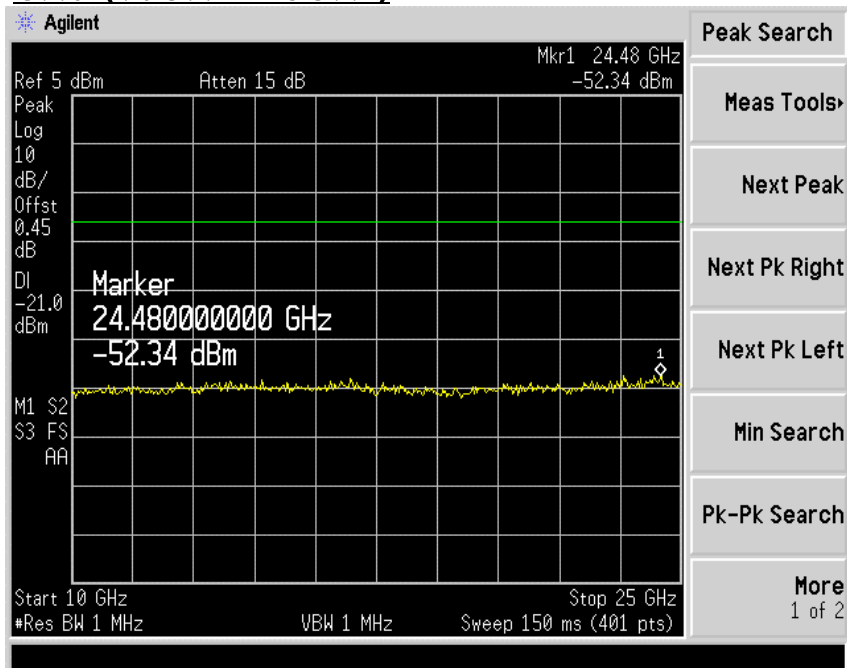


Underwriters Laboratories Inc.

Out of Band Emissions(EDR) CH0 (30MHz~10GHz)



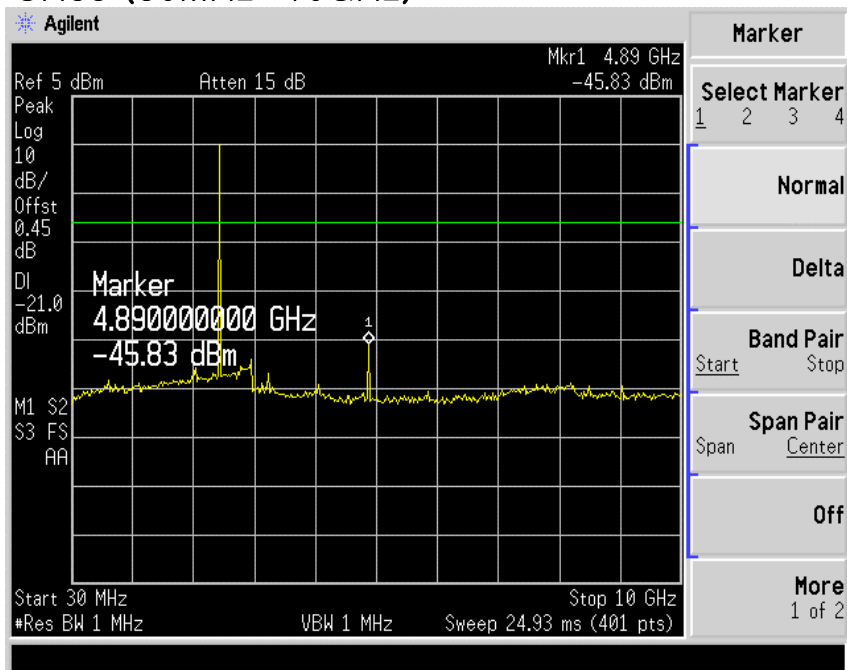
CH0 (10GHz~25GHz)



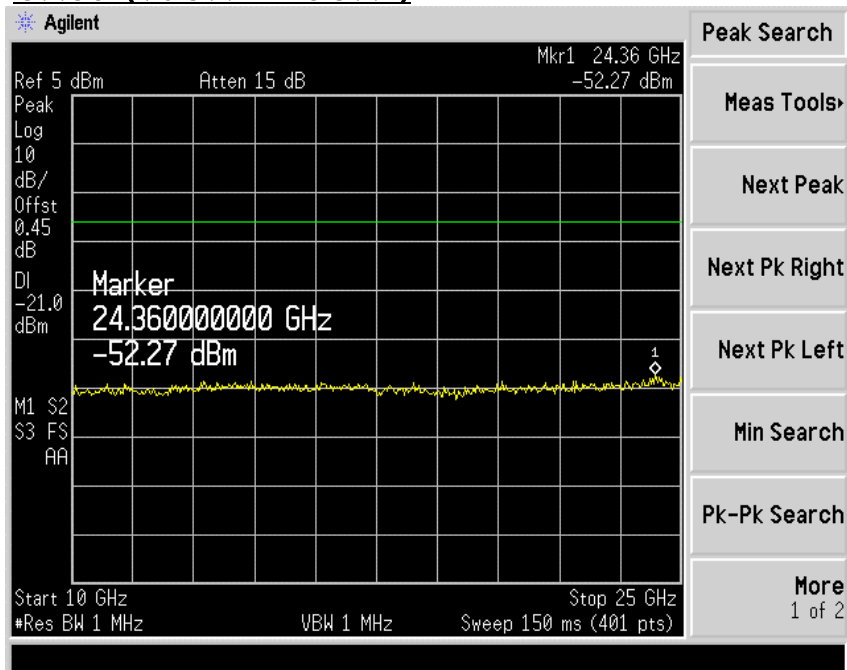


Underwriters Laboratories Inc.

Out of Band Emissions(EDR) CH39 (30MHz~10GHz)



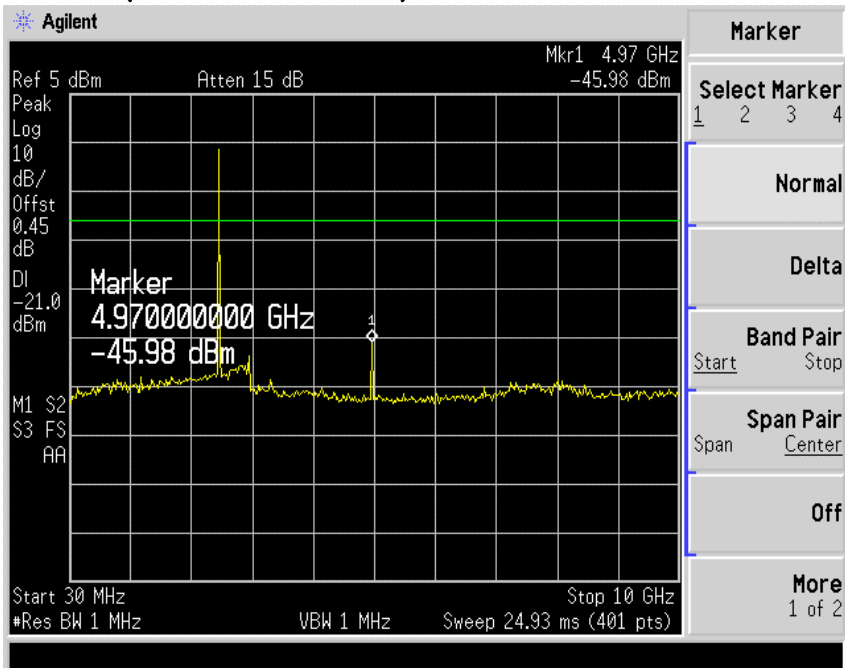
CH39 (10GHz~25GHz)



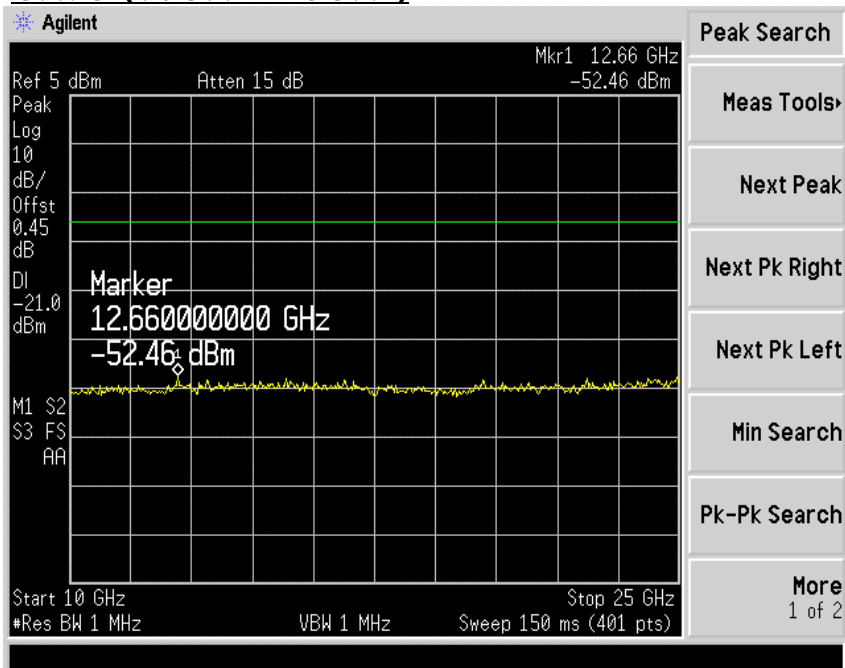


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Out of Band Emissions(EDR) CH78 (30MHz~10GHz)



CH78 (10GHz~25GHz)





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10. Measurement of radiated disturbance

Measurements were made at 3-meter open site that complies to CISPR 16/ANSI C63.4. Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 3-meter. The EUT was rotated 360° about its azimuth with the receive antenna located at 1, 2, 3 and 4 meter heights in both horizontal and vertical polarities. Final measurements (quasi-peak or average as noted) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4-meters. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable.

10.1 Measurement equipments

Equipment Name	Type	Manufacturer	Serial No.	Next Calibration date
TEST Receiver	ESVS10	Rohde & Schwarz	838562/002	2010. 1. 23
LogBicon Antenna	VULB 9160	SCHWARZBECK	3142	2009. 5. 15
Amplifier	8447F	HP	2805A02972	2009. 6. 26
Spectrum Analyzer	R3273	ADVANTEST	121200664	2009. 11. 24
Horn Antenna	BBHA 9120 D	S/B	352	2009. 6. 13
PREAMPLIFIER	8449B	HP	3008A00581	2009. 3. 6
Spectrum Analyzer	R3273	ADVANTEST	121200664	2009. 6. 9
Pre Amplifier	310N	SONOMAINST	185723	2009. 9. 19
Turn Table	2087	EMCO	2129	–
Antenna Mast	2070-01	EMCO	9702-203	–
ANT Mast Controller	2090	EMCO	1535	–
Turn Table Controller	2090	EMCO	1535	–

10.2 Environmental Condition

Test Place : Open site(3m)
 Temperature (°C) : 7 °C
 Humidity (%) : 43 °C



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10.3-1 Test data_

Test Date : 16-Jan-09

Measurement Distance 3m

Test Frequency (MHz)	Meter Reading (dBuV)	Detector (Pk/QP)	Pol.	Azimuth (Degrees)	Antenna Height (cm)	Cable Loss (dB)	ANT. (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
62	10	QP	H	90	4	1.2	11.27	22.47	40	-17.53
120	15.1	QP	H	97	2.8	1.8	11.18	28.04	43.5	-15.46
166.26	14	QP	H	188	2.6	2.1	12.22	28.36	43.5	-15.14
200	11.1	QP	V	45	1	2.3	9.67	23.09	43.5	-20.41
227.7	9	QP	H	91	1.8	2.6	10.63	22.21	46	-23.79
52.84	14.1	QP	V	250	1	1.1	12.26	27.48	40	-12.52
240	13.9	QP	H	55	1.6	2.7	11.05	27.64	46	-18.36
264.04	13.8	QP	H	110	1.2	2.9	11.84	28.54	46	-17.46
360.01	15.8	QP	V	86	1.3	3.7	14.23	33.72	46	-12.28
402.3	20.1	QP	H	270	1	4	15.2	39.33	46	-6.67
452.61	10	QP	H	100	1	4.5	16.5	31.01	46	-14.99
480.02	11	QP	V	360	1	4.6	16.87	32.46	46	-13.54
720	7.7	QP	V	60	1.6	6.6	21.06	35.33	46	-10.67
960.01	3.6	QP	V	95	1.4	8.2	24.06	35.9	54	-18.1
Remark	H : Horizontal, V : Vertical *Checked in all 3 axis and the maximum measured data were reported. *CL = Cable Loss-Amplifier Gain(In case of above1000Mhz) *CL = Cable Loss(In case of below1000Mhz) *The resolution bandwidth and video bandwidth of tes									



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10.3-2 Test data(CH0)

Test Date : 16-Jan-09

Measurement Distance : 3 m

Frequency (MHz)	Reading (dB μ V)	Position (V/H)	Height (m)	Correction Factor		Result Value		
				Ant Factor (dB)	Cable (dB)	Limit (dB μ V/m)	Result (dB μ V/m)	Margin (dB)
PEAK(RBW / VBW-1MHz)								
1319.00	56.80	H	1.2	25.98	-33.4	74.0	49.43	-24.57
1319.00	54.33	V	1.9	25.98	-33.4	74.0	46.96	-27.04
2398.33	24.11	H	1.9	27.31	4.5	74.0	55.92	-18.08
2398.33	23.29	V	1.0	27.31	4.5	74.0	55.10	-18.90
2402.00	55.31	H	1.9	27.31	4.5	*OB	87.12	-
2402.00	54.20	V	1.0	27.31	4.5	*OB	86.01	-
4804.00	54.97	H	1.1	29.95	-29.0	74.0	55.88	-18.12
4804.00	54.40	V	1.1	29.95	-29.0	74.0	55.31	-18.69
EDR								
1601.00	53.18	H	1.1	25.98	-33.4	74.0	45.81	-28.19
1601.00	52.73	V	1.8	25.98	-33.4	74.0	45.36	-28.64
2398.40	25.49	H	1.2	27.31	4.5	74.0	57.30	-16.70
2398.40	25.19	V	1.7	27.31	4.5	74.0	57.00	-17.00
2402.00	57.41	H	1.2	27.31	4.5	*OB	89.22	-
2402.00	59.46	V	1.7	27.31	4.5	*OB	91.27	-
4804.00	46.88	H	1.5	29.95	-29.0	74.0	47.79	-26.21
4804.00	48.88	V	1.0	29.95	-29.0	74.0	49.79	-24.21
AV(RBW 1MHz / VBW 10Hz)								
1319.00	53.59		1.2	25.98	-33.4	54.0	46.22	-7.78
1319.00	49.55	V	1.9	25.98	-33.4	54.0	42.18	-11.82
2398.33	12.73	H	1.9	27.31	4.5	54.00	44.54	-9.46
2398.33	12.77	V	1.0	27.31	4.5	54.00	44.58	-9.42
2402.00	52.09	H	1.9	27.31	4.5	*OB	83.90	-
2402.00	53.51	V	1.0	27.31	4.5	*OB	85.32	-
4804.00	38.85	H	1.1	29.95	-29.0	54.0	39.76	-14.24
4804.00	39.24		1.1	29.95	-29.0	54.0	40.15	-13.85
EDR								
1601.00	46.54	H	1.1	25.98	-33.4	54.0	39.17	-14.83
1601.00	46.92	V	1.8	25.98	-33.4	54.0	39.55	-14.45
2398.40	14.43	H	1.2	27.31	4.5	54.00	46.24	-7.76
2398.40	15.08	V	1.7	27.31	4.5	54.00	46.89	-7.11
2402.00	57.16	H	1.2	27.31	4.5	*OB	88.97	-
2402.00	55.93	V	1.7	27.31	4.5	*OB	87.74	-
4804.00	37.92	H	1.5	29.95	-29.0	54.0	38.83	-15.17
4804.00	42.36	V	1.0	29.95	-29.0	54.0	43.27	-10.73
Remark	H : Horizontal, V : Vertical TEST MODE : CH 0(2402MHz) *The TX signal isn't detected from 2th harmonics. *OB = Operating band *Checked in all 3 axis and the maximum measured data were reported. *CL = Cable Loss-Amplifier Gain(In case of above1000Mh							



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10.3-3 Test data(CH39)

Test Date : 16-Jan-09

Measurement Distance : 3 m

Frequency (MHz)	Reading (dB μ V)	Position (V/H)	Height (m)	Correction Factor		Result Value		
				Ant Factor (dB)	Cable (dB)	Limit (dB μ V/m)	Result (dB μ V/m)	Margin (dB)
PEAK(RBW / VBW-1MHz)								
1320.00	56.41	H	1.1	25.98	-33.4	74.0	49.04	-24.96
1320.00	53.59	V	1.8	25.98	-33.4	74.0	46.22	-27.78
2441.00	55.06	H	1.7	27.31	4.5	*OB	86.87	-
2441.00	56.71	V	1.1	27.31	4.5	*OB	88.52	-
4882.00	49.92	H	1.0	29.95	-29.0	74.0	50.83	-23.17
4882.00	48.86	V	1.4	29.95	-29.0	74.0	49.77	-24.23
EDR								
1440.00	54.24	H	1.8	25.98	-33.4	74.0	46.87	-27.13
1440.00	54.73	V	1.1	25.98	-33.4	74.0	47.36	-26.64
1627.00	53.92	H	1.1	25.98	-33.4	74.0	46.55	-27.45
1627.00	54.70	V	1.1	25.98	-33.4	74.0	47.33	-26.67
2441.00	59.90	H	1.0	27.31	4.5	*OB	91.71	-
2441.00	57.59	V	1.9	27.31	4.5	*OB	89.40	-
4882.00	49.45	H	1.7	29.95	-29.0	74.0	50.36	-23.64
4882.00	49.13	V	1.7	29.95	-29.0	74.0	50.04	-23.96
AV(RBW 1MHz / VBW 10Hz)								
1320.00	53.17	H	1.1	25.98	-33.4	54.0	45.80	-8.20
1320.00	49.78	V	1.8	25.98	-33.4	54.0	42.41	-11.59
2441.00	54.95		1.7	27.31	4.5	*OB	86.76	-
2441.00	56.70	V	1.1	27.31	4.5	*OB	88.51	-
4882.00	45.60	H	1.0	29.95	-29.0	54.0	46.51	-7.49
4882.00	43.89	V	1.4	29.95	-29.0	54.0	44.80	-9.20
EDR								
1440.00	50.11	H	1.8	25.98	-33.4	54.0	42.74	-11.26
1440.00	50.13	V	1.1	25.98	-33.4	54.0	42.76	-11.24
1627.00	47.91		1.1	25.98	-33.4	54.0	40.54	-13.46
1627.00	50.80	V	1.1	25.98	-33.4	54.0	43.43	-10.57
2441.00	59.60	H	1.0	27.31	4.5	*OB	91.41	-
2441.00	57.14	V	1.9	27.31	4.5	*OB	88.95	-
4882.00	44.48	H	1.7	29.95	-29.0	54.0	45.39	-8.61
4882.00	43.27	V	1.7	29.95	-29.0	54.0	44.18	-9.82
Remark	H : Horizontal, V : Vertical TEST MODE : CH 39 (2441MHz) *The TX signal isn't detected from 2th harmonics. *OB = Operating band *Checked in all 3 axis and the maximum measured data were reported. *CL = Cable Loss-Amplifier Gain(In case of above1000							



Underwriters Laboratories Inc.

10.3-4 Test data(CH78)

Test Date : 16-Jan-09

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)
PEAK(RBW / VBW-1MHz)								
1320.00	56.56	H	1.1	25.98	-33.4	74.0	49.19	-24.81
1320.00	57.34	V	1.2	25.98	-33.4	74.0	49.97	-24.03
2480.00	56.40	H	1.5	27.31	4.5	*OB	88.21	-
2480.00	56.81	V	1.0	27.31	4.5	*OB	88.62	-
2484.09	23.75	H	1.5	27.31	4.5	74.00	55.56	-18.44
2484.09	24.58	V	1.0	27.31	4.5	74.00	56.39	-17.61
4960.00	54.84	H	1.1	29.95	-29.0	75.0	55.75	-19.25
4960.00	53.10	V	1.3	29.95	-29.0	74.0	54.01	-19.99
EDR								
1319.00	54.44	H	1.1	25.98	-33.4	74.0	47.07	-26.93
1319.00	52.29	V	1.4	25.98	-33.4	74.0	44.92	-29.08
2480.00	58.61	H	1.6	27.31	4.5	*OB	90.42	-
2480.00	58.73	V	1.7	27.31	4.5	*OB	90.54	-
2484.54	25.66	H	1.6	27.31	4.5	74.00	57.47	-16.53
2484.54	25.24	V	1.7	27.31	4.5	74.00	57.05	-16.95
4960.00	49.80	H	1.6	29.95	-29.0	74.00	50.71	-23.29
4960.00	49.84	V	1.1	29.95	-29.0	74.00	50.75	-23.25
AV(RBW 1MHz / VBW 10Hz)								
1320.00	54.06		1.1	25.98	-33.4	54.0	46.69	-7.31
1320.00	55.15	V	1.2	25.98	-33.4	54.0	47.78	-6.22
2480.00	55.70	H	1.5	27.31	4.5	*OB	87.51	-
2480.00	56.24	V	1.0	27.31	4.5	*OB	88.05	-
2484.09	13.24	H	1.5	27.31	4.5	54.00	45.05	-8.95
2484.09	13.42	V	1.0	27.31	4.5	54.00	45.23	-8.77
4960.00	45.24	H	1.1	29.95	-29.0	54.0	46.15	-7.85
4960.00	47.00		1.3	29.95	-29.0	54.0	47.91	-6.09
EDR								
1319.00	49.07	H	1.1	25.98	-33.4	54.0	41.70	-12.30
1319.00	46.06	V	1.4	25.98	-33.4	54.0	38.69	-15.31
2480.00	57.90	H	1.6	27.31	4.5	*OB	89.71	-
2480.00	58.38	V	1.7	27.31	4.5	*OB	90.19	-
2484.54	13.97	H	1.6	27.31	4.5	54.00	45.78	-8.22
2484.54	13.85	V	1.7	27.31	4.5	54.00	45.66	-8.34
4960.00	44.86	H	1.6	29.95	-29.0	54.00	45.77	-8.23
4960.00	46.34	V	1.1	29.95	-29.0	54.00	47.25	-6.75
Remark	H : Horizontal, V : Vertical TEST MODE : CH 78 (2480MHz) *The TX signal isn't detected from 2th harmonics. *OB = Operating band *Checked in all 3 axis and the maximum measured data were reported. *CL = Cable Loss-Amplifier Gain(In case of above1000							

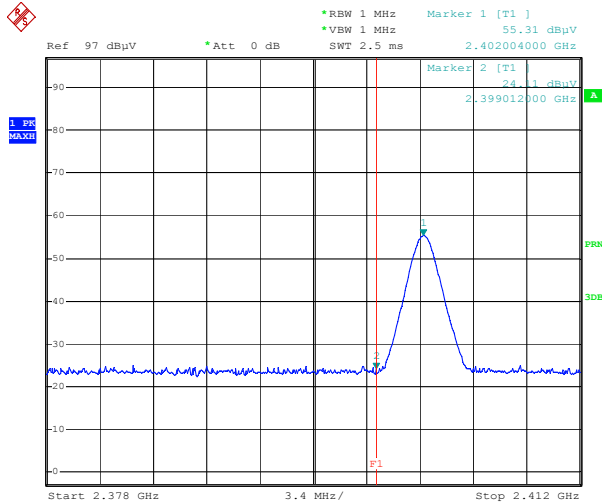


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10.3-5 Restricted Band Edges

Band Edges(CH Low)

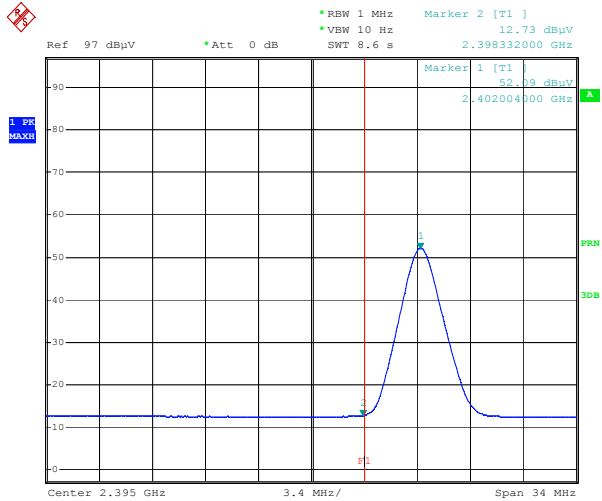
Detector mode:Peak



Comment: MR-2000_BT_CH0_PK_HOR
Date: 20.JAN.2009 11:25:04

BT(1.0)

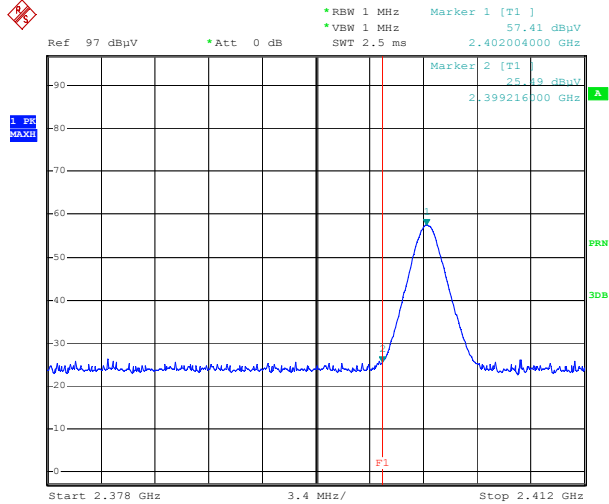
Detector mode:Average



Comment: MR-2000_BT_CH0_AV_HOR
Date: 20.JAN.2009 11:28:35

BT(1.0)

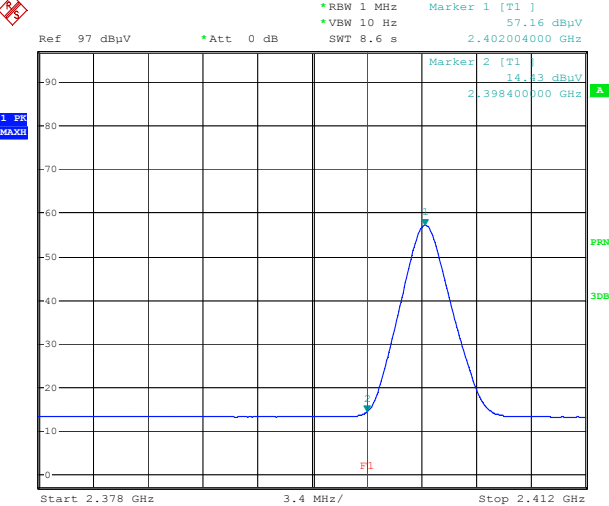
Polarity:Horizontal



Comment: MR-2000_BT(EDR)_CH0_PK_HOR
Date: 19.FEB.2009 15:44:20

BT-EDR

Polarity:Horizontal



Comment: MR-2000_BT(EDR)_CH0_AV_HOR
Date: 19.FEB.2009 15:45:04

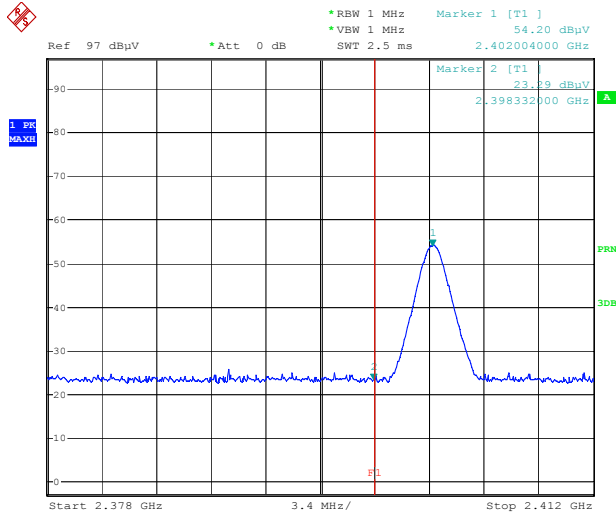
BT-EDR



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Band Edges(CH Low)

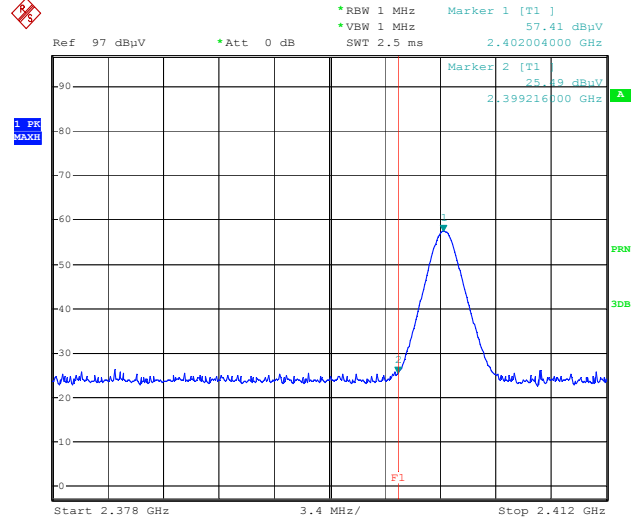
Detector mode:Peak



Comment: MR-2000_BT_CH0_PK_VER
Date: 20.JAN.2009 11:34:52

BT(1.0)

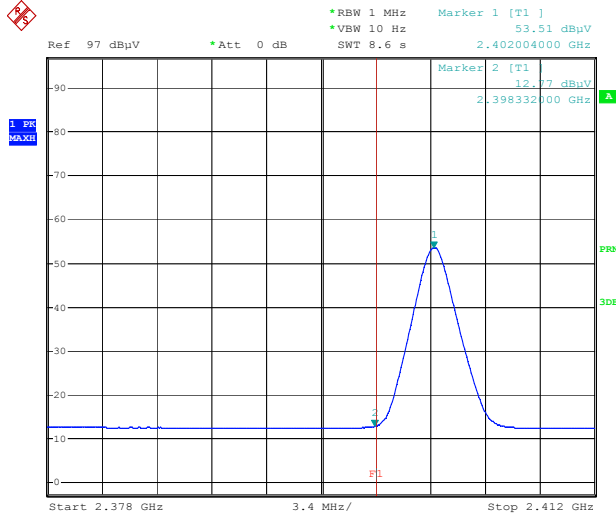
Polarity:Vertical



Comment: MR-2000_BT(EDR)_CH0_PK_HOR
Date: 19.FEB.2009 15:44:20

BT-EDR

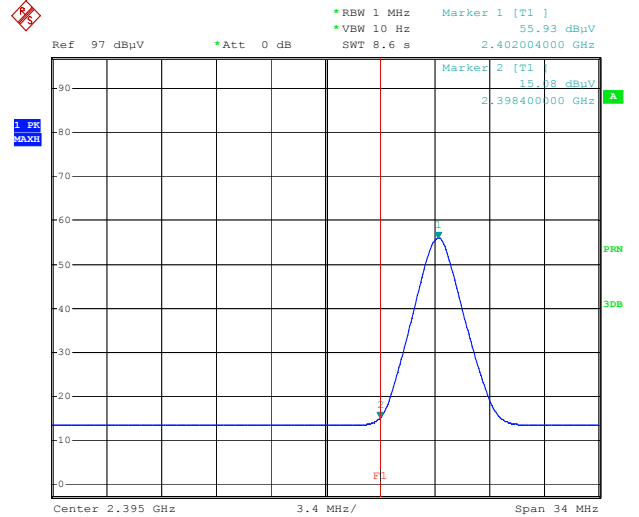
Detector mode:Average



Comment: MR-2000_BT_CH0_AV_VER
Date: 20.JAN.2009 11:31:20

BT(1.0)

Polarity:Vertical



Comment: MR-2000_BT(EDR)_CH0_AV_VER
Date: 19.FEB.2009 15:34:50

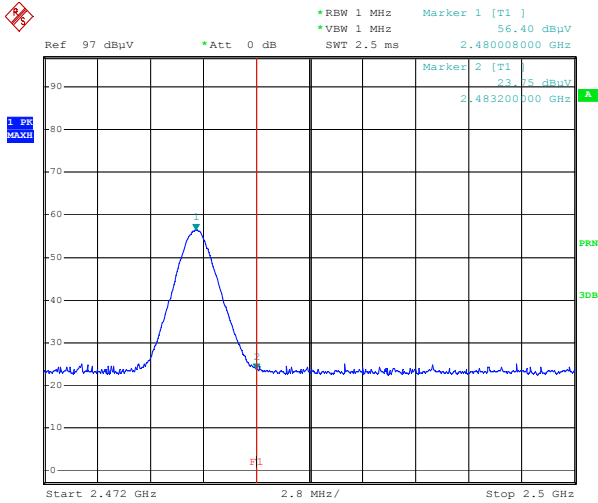
BT-EDR



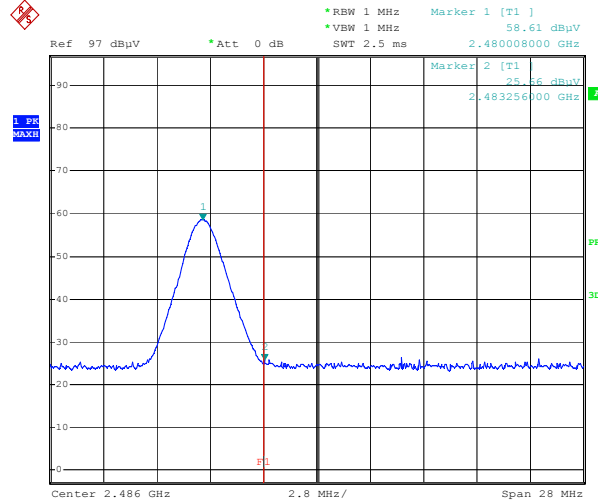
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Band Edges(CH High)

Detector mode:Peak

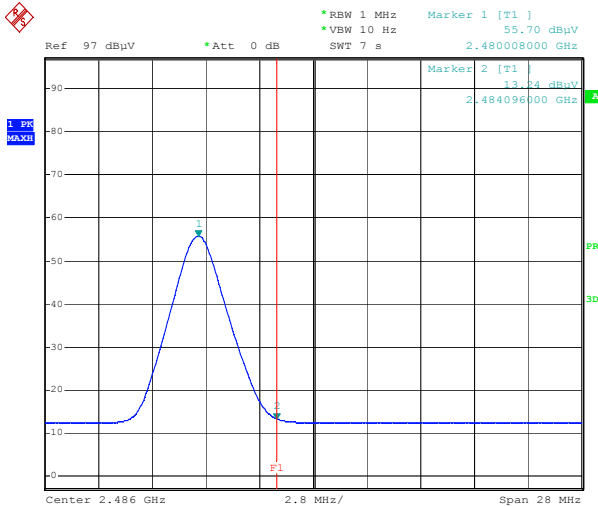
Comment: MR-2000_BT_CH78_PK_HOR
Date: 20.JAN.2009 11:45:15

Polarity:Horizontal

Comment: MR-2000_BT(EDR)_CH78_PK_HOR
Date: 19.FEB.2009 15:09:07

BT(1.0)

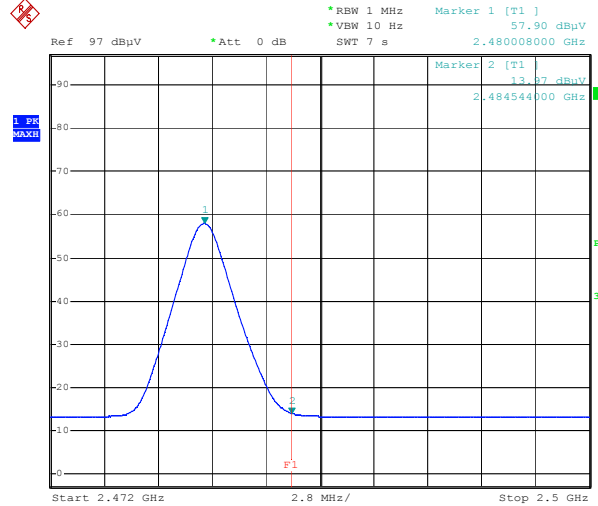
Detector mode:Average

Comment: MR-2000_BT_CH78_AV_HOR
Date: 20.JAN.2009 11:49:21

BT(1.0)

BT-EDR

Polarity:Horizontal

Comment: MR-2000_BT(EDR)_CH78_AV_HOR
Date: 19.FEB.2009 15:06:48

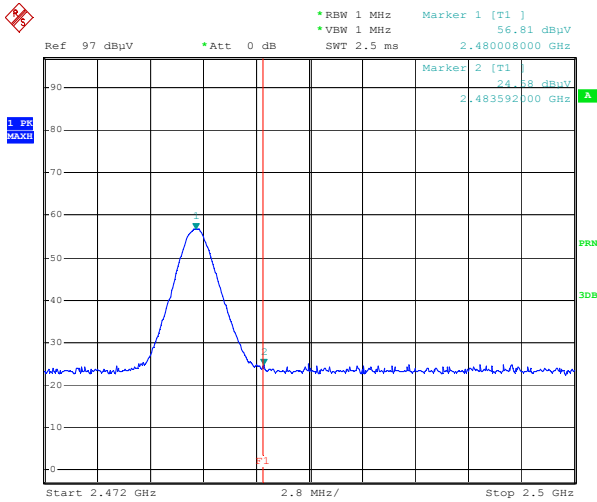
BT-EDR



Underwriters Laboratories Inc.

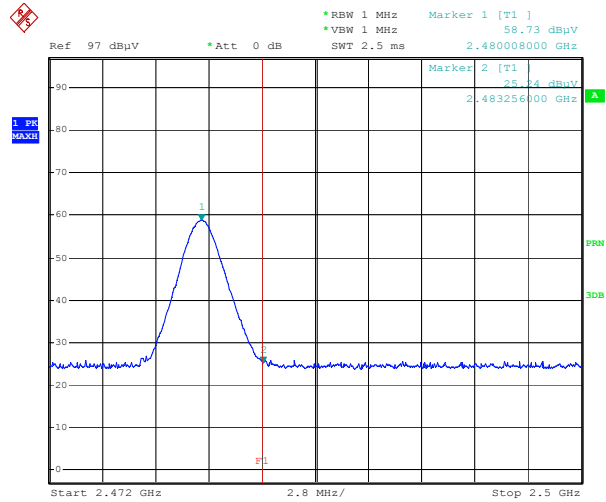
Band Edges(CH High)

Detector mode:Peak



Comment: MR-2000_BT_CH78_PK_VER
Date: 20.JAN.2009 11:40:44

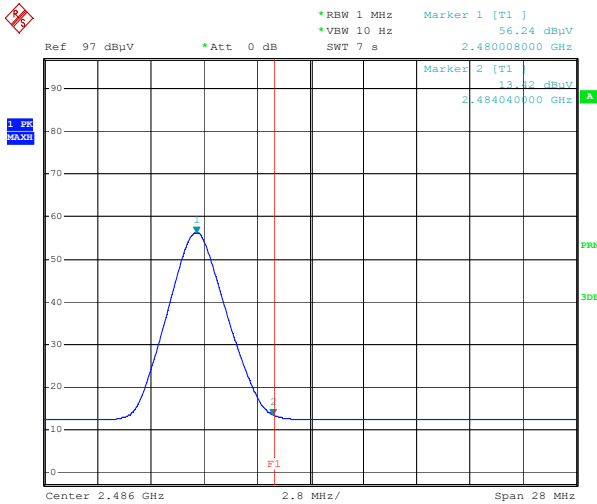
Polarity:Vertical



Comment: MR-2000_BT(EDR)_CH78_PK_VER
Date: 19.FEB.2009 15:02:01

BT(1.0)

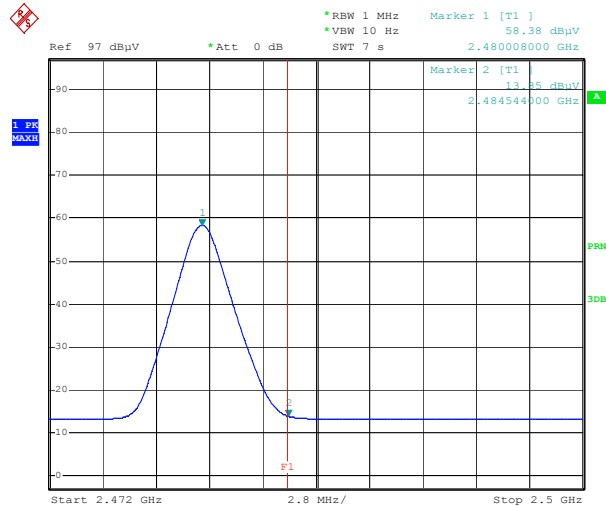
Detector mode:Average



Comment: MR-2000_BT_CH78_AV_VER
Date: 20.JAN.2009 11:42:33

BT-EDR

Polarity:Vertical



Comment: MR-2000_BT(EDR)_CH78_AV_VER
Date: 19.FEB.2009 15:04:05

BT(1.0)

BT-EDR



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11. Measurement of conducted disturbance

The continuous disturbance voltage of AC Mains in the frequency from 0.15 to 30 MHz was measured in accordance to FCC Part 15 (2006) & ANSI C 63.4 (2003). The test setup was made according to FCC Part 15 (2006) & ANSI C 63.4 (2003) in a shielded. Measurements were made on a ground plane that extends 1-meter minimum beyond all sides of the system under test. All power was connected to the system through Artificial Mains Network (AMN). Conducted voltage measurements on mains lines were made at the output of the AMN.

11.1 Measurement equipments

Equipment Name	Type	Manufacturer	Serial No.	Next Calibration date
LISN	ESH3-Z5	Schwarzbeck	838979/010	2009. 2. 28
LISN	NNLA8120A	Schwarzbeck	8120161	2009. 2. 28
TEST Receiver	ESPI7	Rohde & Schwarz	100185	2009. 8. 27
Pulse Limiter	ESH3Z2	Rohde & Schwarz	NONE	2009. 9. 10

11.2 Environmental Condition

Test Place : Shield Room

Temperature (°C) : 21 °C

Humidity (%) : 42 %



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11.3-1 Conducted Emission Test data_Download Mode

Test Date : 16-Jan-09

Test Frequency (MHz)	Correction Factor		Reading value(dBuV)		Line	Level(dBuV)		Limit (dBuV)		Margin (dB)	
	Cable	LISN	QP	AV		QP	AV	QP	AV	QP	AV
0.19	0.2	0.17	42.18	36.54	N	42.58	36.94	64.04	54.04	21.46	17.1
0.2	0.2	0.17	43.76	35.83	N	44.16	36.23	63.74	53.74	19.58	17.51
0.25	0.2	0.19	35.23	29.67	H	35.65	30.09	61.63	51.63	25.97	21.53
0.26	0.2	0.19	40.17	35.97	H	40.59	36.39	61.5	51.5	20.9	15.1
0.58	0.4	0.2	29.62	27.19	N	30.19	27.76	56	46	25.81	18.24
0.65	0.4	0.2	30.54	19.49	H	31.12	20.07	56	46	24.88	25.93
1.04	0.5	0.18	29.72	26.77	H	30.41	27.46	56	46	25.59	18.54
1.1	0.5	0.18	30.19	27.45	H	30.88	28.14	56	46	25.12	17.86
6.02	0.7	0.41	32.17	27.32	H	33.27	28.42	60	50	26.73	21.58
6.23	0.7	0.42	28.73	21.53	N	29.86	22.66	60	50	30.14	27.34
6.93	0.8	0.47	33.22	23.87	H	34.45	25.1	60	50	25.55	24.9
7.12	0.8	0.48	32.75	31.12	H	34	32.37	60	50	26	17.66
8.55	0.8	0.49	33.01	30.91	H	34.33	32.23	60	50	25.67	17.77
Remark	H : Hot Line, N : Neutral Line										



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11.3-2 Conducted Emission Test data_Recording Mode

Test Date : 16-Jan-09

Test Frequency (MHz)	Correction Factor		Reading value(dBuV)		Line	Level(dBuV)		Limit (dBuV)		Margin (dB)	
	Cable	LISN	QP	AV		QP	AV	QP	AV	QP	AV
0.19	0.2	0.17	42.18	36.54	N	42.58	36.94	64.04	54.04	21.46	17.1
0.2	0.2	0.17	43.76	35.83	N	44.16	36.23	63.74	53.74	19.58	17.51
0.25	0.2	0.19	35.23	29.67	H	35.65	30.09	61.63	51.63	25.97	21.53
0.26	0.2	0.19	40.17	35.97	H	40.59	36.39	61.5	51.5	20.9	15.1
0.58	0.4	0.2	29.62	27.19	N	30.19	27.76	56	46	25.81	18.24
0.65	0.4	0.2	30.54	19.49	H	31.12	20.07	56	46	24.88	25.93
1.04	0.5	0.18	29.72	26.77	H	30.41	27.46	56	46	25.59	18.54
1.1	0.5	0.18	30.19	27.45	H	30.88	28.14	56	46	25.12	17.86
6.02	0.7	0.41	32.17	27.32	H	33.27	28.42	60	50	26.73	21.58
6.23	0.7	0.42	28.73	21.53	N	29.86	22.66	60	50	30.14	27.34
6.93	0.8	0.47	33.22	23.87	H	34.45	25.1	60	50	25.55	24.9
7.12	0.8	0.48	32.75	31.12	H	34	32.37	60	50	26	17.66
8.55	0.8	0.49	33.01	30.91	H	34.33	32.23	60	50	25.67	17.77
Remark	H : Hot Line, N : Neutral Line										



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12. Antenna Requirement

12.1 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 15.24

12.2 Antenna Connected Construction

The antenna types used in this product are internal Antenna. The maximum Gain of this antenna is -2.0 dBi.

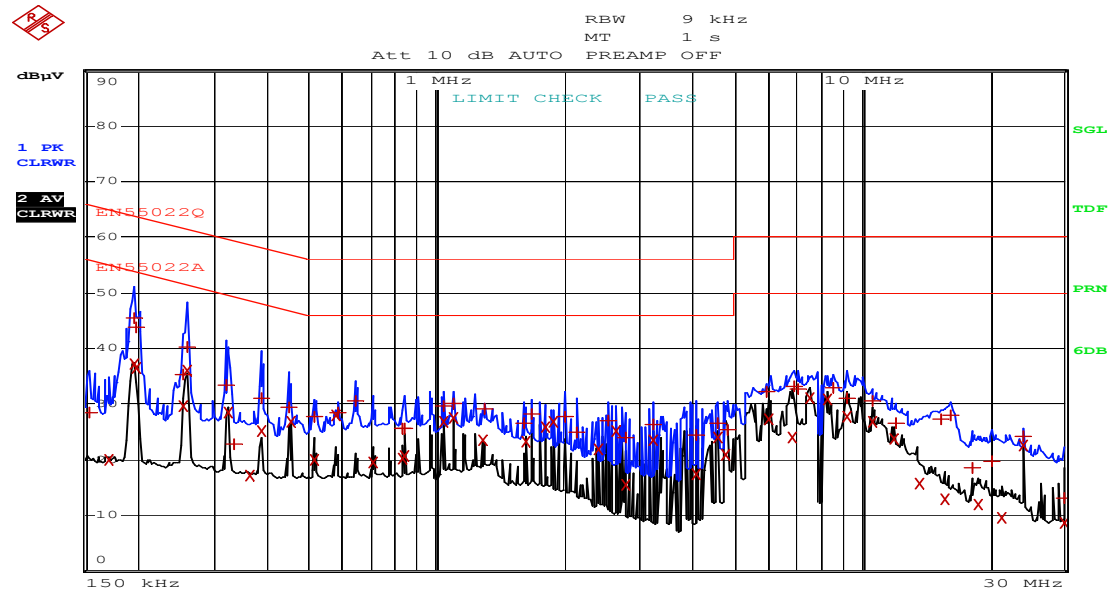


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Appendix 1. Spectral diagram

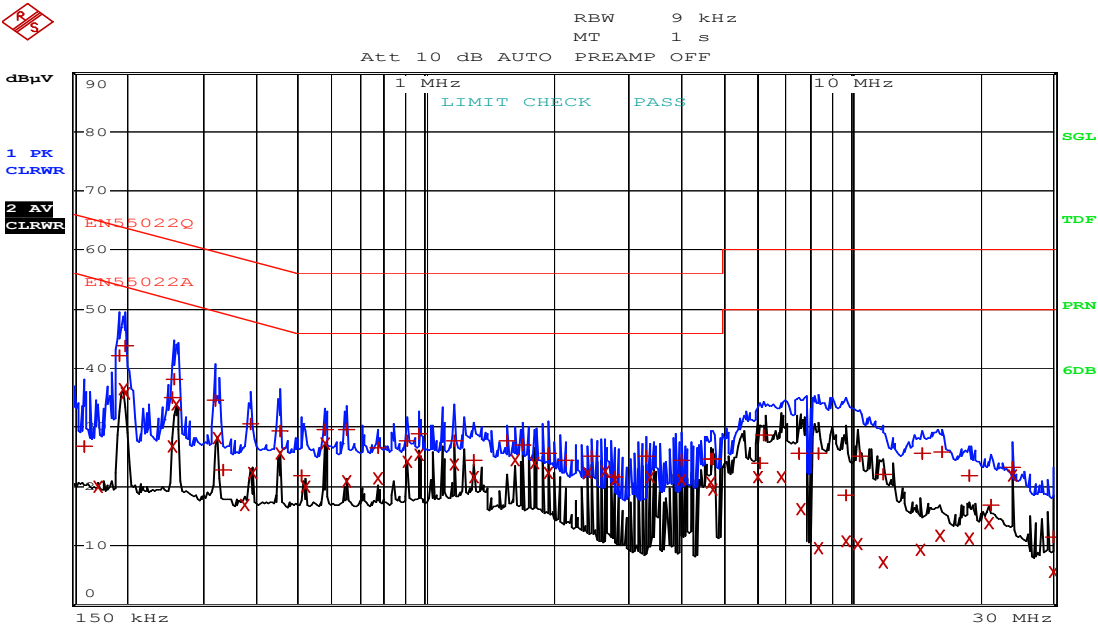
Download mode

*HOT



Comment: MR-2000_DOWN_HOT
Date: 1.DEC.2008 11:42:14

*NEUTRAL



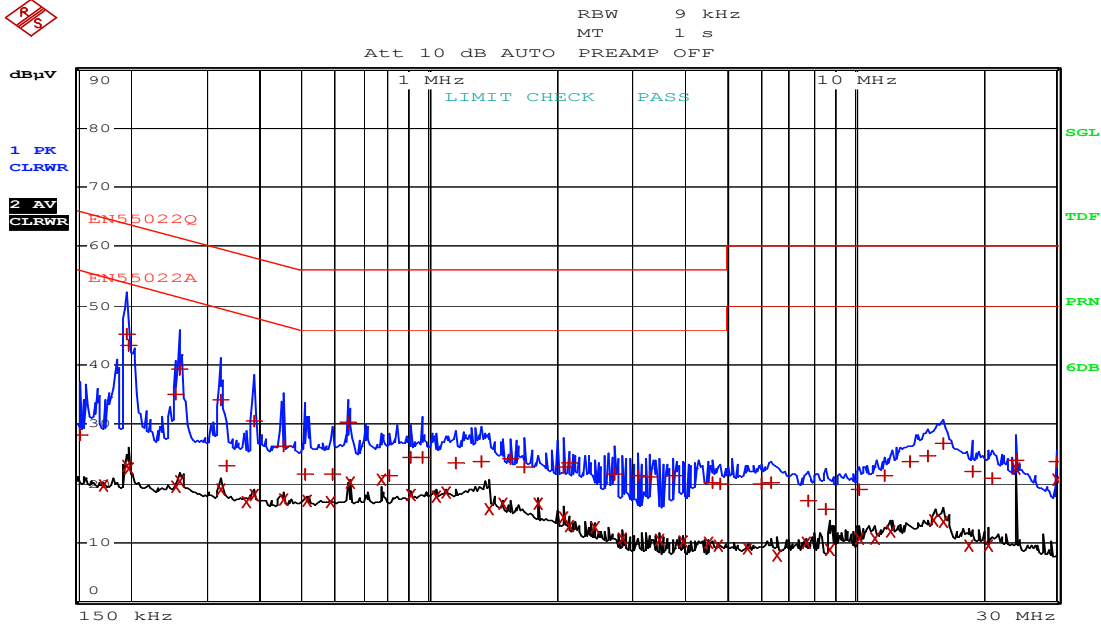
Comment: MR-2000_DOWN_NEUTRAL
Date: 1.DEC.2008 11:27:14



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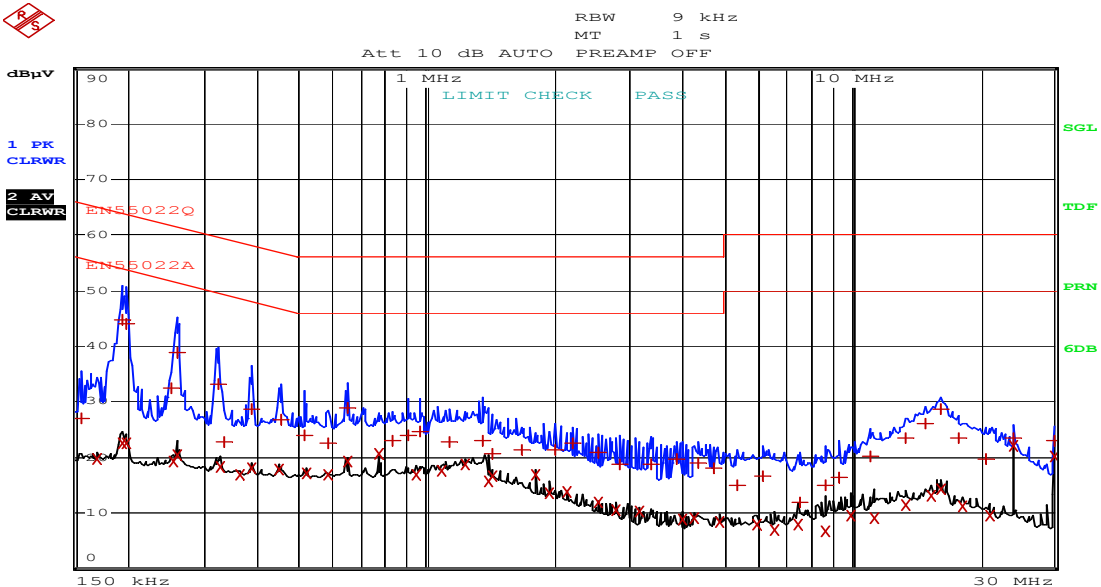
Recording mode

*HOT



Comment: MR-2000_UP_HOT
Date: 1.DEC.2008 11:58:12

*NEUTRAL



Comment: MR-2000_UP_NEUTRAL
Date: 1.DEC.2008 12:04:03