

Report No.: EH/2013/40021 Issue Date: Jun. 06, 2013

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ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT

OF

Product Name: PDA Phone

Brand Name: Sony

Model No.: C1905

Type No.: PM-0490-BV

Model Difference: N/A

FCC ID: PY7PM-0490

Report No.: EH/2013/40021

Issue Date: Jun. 06, 2013

FCC Rule Part: §15.247, Cat: DSS

Sony Mobile Communications AB Prepared for:

Nya Vattentornet 22188 Lund/SWEDEN

SGS Taiwan Ltd.

Electronics & Communication Laboratory

No.134, Wu Kung Road, New Taipei Industrial Prepared by:

Park, Wuku District, New Taipei City, Taiwan

24803





Testing Laboratory 0513

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VERIFICATION OF COMPLIANCE

Applicant: Sony Mobile Communications AB

Nya Vattentornet 22188 Lund/SWEDEN

PDA Phone **Product Name:**

Brand Name: Sony

Model No.: C1905

Type No.: PM-0490-BV

Model Difference: N/A

FCC ID: PY7PM-0490

File Number: EH/2013/40021

Date of test: Apr. 01, 2013 ~ May. 20, 2013

Date of EUT Received: Apr. 01, 2013

We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. Electronics & Communication Laboratory The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4:2009 & ANSI C63.10:2009 and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits of FCC Rules Part 15.247.

The test results of this report relate only to the tested sample identified in this report.

11 1 1

Test By:	Marcus Iseng	Date:	Jun. 06, 2013	
Prepared By:	Marcus Tseng/Engineer Utoletta Tang	Date:	Jun. 06, 2013	
Approved By:	Violetta Tang / Clerk Jim Chang / Supervisor	Date:	Jun. 06, 2013	

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Revision History

Report Number	Revision	Description	Issue Date
EH/2013/40021	Rev.01	Initial creation of document	May. 20, 2013
EH/2013/40021	Rev.02	1. Update Product Description "Marketing Name" into "Model No." and update "Model No." into "Type No." on Page 1, 2 and 7. 2. Update Product Description "M/N: PM-0490-BV" into "M/N: C1905" on Page 21 and 22.	Jun. 06, 2013

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GENERAL INFORMATION

1.1. Product description

General:

Jeneral.			
Product Name:	PDA Phone		
Brand Name:	Sony		
Model No.:	C1905		
Type No.:	PM-0490-	BV	
Model Difference:	N/A		
Data Cable (USB):		: EC450, Supplier: K-one 242-6715.3, Length: 100 cm	
Simple Hands-Free (SHF-White):	Model No. Type No.:	: MH410c, Supplier: Foster Electric AG-1100	
Simple Hands-Free (SHF-Black):	Model No.: MH410c, Supplier: Foster Electric Type No.: CCA-0004017		
Car Charger:	Model No.: AN400, Supplier: Salcomp Type No.: CAA-0003013		
Hi-Fi Wireless Headset:	Model No.: MW600, Supplier: BALDA Type No.: DDA-0002029.B coupling with Simple Hands Free (Model No.: MH755, Supplier: BALDA Type No.: AG-0502)		
Hardware Version:	A		
Software Version:	15.1.A.1.3		
	3.7Vdc		
Power Supply:	Battery:	Model No.: BA900, Supplier: Sony Type No.: AB-0500	
	Adapter:	Model No.: EP800, Supplier: Salcomp Type No.: CAA-0002016-US	

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Bluetooth_BR+EDR:

Bluetooth Version:	V3.0+HS
Channel number:	79 channels
Modulation type:	Frequency Hopping Spread Spectrum
Transmit Power:	9.22dBm
Frequency Range:	2.402GHz – 2.480GHz
Dwell Time:	<= 0.4s
Antenna Designation:	PIFA Antenna, Gain: 2.55dBi

Bluetooth Low Energy:

Frequency Range:	2402 – 2480MHz
Bluetooth Version:	V4.0 Dual mode
Channel number:	40 channels
Modulation type:	GFSK
Transmit Power:	1.46dBm (Peak)
Antenna Designation:	PIFA Antenna, Gain: 2.55dBi

NFC:

Operating Frequency	13.56MHz
Transmit Power	< 123dBuV/m at 3m.
Number of Channels	1
Antenna Type	Loop Antenna
Modulation Type	ASK, BPSK

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WLAN 2.4GHz+5.7GHz:

Wi-Fi	Frequency Range	Channels	Rated Power	Modulation Technology
11b/g	2412-2462	11	b: 17.61dBm g: 21.00dBm	DSSS, OFDM
11n	HT20 2412-2462	11	HT20: 21.11dBm	OFDM
11a	5725-5850	5	a: 20.12dBm	
11n (5GHz)	HT20 5725-5850	5	HT20: 20.13dBm	OFDM
11n (5GHz)	HT40 5725-5850	2	HT40: 19.66dBm	
Antenna Designation:		PIFA Antenna, 2.4GHz Gain: 2.55dBi 5GHz Gain: 1.66dBi (5725MHz-5850MHz)		Hz-5850MHz)
Modulation type:		CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM		
Transition Rate:		802.11 a: 6/9/12/18/24/36/48/54 Mbps 802.11 b: 1/2/5.5/11 Mbps 802.11 g: 6/9/12/18/24/36/48/54 Mbps 802.11 n_20MHz: 6.5 – 65.0Mbps 802.11 n_40MHz: 13.5 – 135.0Mbps		

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WLAN 5GHz

Wi-Fi	Frequency Range	Channels	Rated Power (Avg)	Modulation Technology	
	5150~5250	4	12.85dBm		
11a	5250~5350	4	12.81dBm	OFDM	
	5470~5725	11	12.94dBm		
	HT20 5150~5250	4	HT20: 12.87dBm		
11n	HT20 5250~5350	4	HT20: 12.87dBm	OFDM	
	HT20 5470~5725	8	HT20: 12.94dBm		
	HT40 5150~5250	2	HT40: 11.77dBm		
11n	HT40 5250~5350	2	HT40: 11.83dBm	OFDM	
	HT40 5470~5725	3	HT40: 11.88dBm		
Antenna Designation		PIFA Antenna, 5GHz Gain: -0.74dBi (5150MHz-5250MHz) 5GHz Gain: 1.01dBi (5250MHz-5350MHz) 5GHz Gain: 2.70dBi (5470MHz-5725MHz)			
Modulation type		CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM			
Transition Rate:		802.11 a: 6/9/12/18/24/36/48/54 Mbps 802.11 n_20MHz: 6.5 – 65.0Mbps 802.11 n_40MHz: 13.5 – 135.0Mbps			

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GSM:

	Operating Frequency	Rated Power	
Cellular Phone	GSM/GPRS 850, Class 12	824.2 MHz– 848.8 MHz	33dBm
Standards Frequency	EDGE 850, Class 12	824.2 MHz– 848.8 MHz	27dBm
Range and Power.	GSM/GPRS 1900, Class 12	1850.2MHz – 1909.8MHz	30dBm
	EDGE 1900, Class 12 1850.2MHz – 1909.8MHz		26dBm
Type of Emission:	GSM 850: 248KGXW, GSM 19 GPRS 850: 246KGXW, GPRS 2 EDGE 850: 249KG7W, EDGE		
IMEI:	004402146593334		

The report applied for Bluetooth BR+EDR.

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1.2. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for FCC ID: PY7PM-0490 filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules. The composite system (digital device) is compliance with FCC part 15, Subpart B is authorized under the certification procedure.

1.3. Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.4:2009 and ANSI C63.10:2009. Radiated testing was performed at an antenna to EUT distance 3 meters. Tested in accordance with FCC Public Notice DA 00-705 - Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems

1.4. Test Facility

The measurement facilities used to collect the 3m Radiated Emission and AC power line conducted data are located on the address of SGS Taiwan Ltd. Electronics & Communication Laboratory No.134, Wu Kung Road, Wuku Industrial Zone, Taipei County, Taiwan which are constructed and calibrated to meet the FCC requirements in documents ANSI C63.4:2009. & ANSI C63.10:2009. FCC Registration Number are: 990257. Canada Registration Number: 4620A-4.

The 10 m Open Area Test Sites located on the address of SGS Taiwan Ltd. Electronics & Communication Laboratory No. 29, Pau-Tou-Tsuo Valley Chia-Pau Tsuen, Linkou Hsiang, Taipei county, which is constructed and calibrated to meet the CISPR 22/EN 55022 requirements. SGS Site No. 1(3 &10 meters) and FCC Registration Number: 94644.

1.5. Special Accessories

There is no special accessory used while test was conducted.

1.6. Equipment Modifications

There was no modification incorporated into the EUT.

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SYSTEM TEST CONFIGURATION

2.1. EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

2.2. EUT Exercise

An engineering test mode (software/firmware) that applicant provided was utilized to manipulate the EUT into transmit, selection of the test channel, and modulation scheme.

2.3. Test Procedure

2.3.1 Conducted Emissions

The EUT is a placed on as turn table which is 0.8 m above ground plane. According to the general criterion in Section 7.1 of ANSI C63.4:2009 & 6.2 ANSI 63.10:2009. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz, and the measurement procedure 7.3 in ANSI 63.4:2009 & 6.2.2, and 6.2.3 in ANSI 63.10:2009 is followed to carry out the test. The CISPR Quasi-Peak and Average detector mode is employed according to §15.107

2.3.2 Radiated Emissions

The EUT is a placed on as turn table which is 0.8 m above ground plane. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna. according to the requirements in Section 8 and 13 and of ANSI C63.4:2009, & Section 6.3, 6.4, 6.5, and 6.6 of ANSI 63.10:2009.ANSI C63.10:2009.and DA 00-705.

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2.4. Configuration of Tested System

Fig. 2-1 Radiated Emission

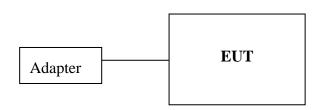


Fig. 2-2 Conducted (Antenna Port) Configuration

EUT

Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1.	Bluetooth Test Software	QRCT	2.4.83.0	N/A	N/A	N/A
2.	Bluetooth Test Set	Anritsu	MT8852B	6k00006107	N/A	N/A

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Fig. 2-3 AC Power Line Conducted Emission

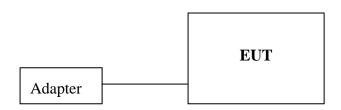


Table 2-2 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
2.	Bluetooth Test Software	QRCT	2.4.83.0	N/A	N/A	N/A

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SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§15.207(a)	AC Power Line Conducted Emission	Compliant
§15.247(b)(1)	Peak Output Power	Compliant
§15.247(a)(1)	20dB Bandwidth	Compliant
§15.247(d)	100 kHz Bandwidth Of Frequency Band Edges	Compliant
\$15.247(d) \$15.209(a) (f)	Spurious Emission	Compliant
§15.247(a)(1)	Frequency Separation	Compliant
§15.247(a)(1)(iii)	Number of hopping frequency	Compliant
§15.247(a)(1)(iii)	Time of Occupancy	Compliant
§15.203,	Antenna Requirement	Compliant

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4. DESCRIPTION OF TEST MODES

The EUT has been tested under operating condition. Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

Channel Low, Mid and High with highest rated data rate were chosen as worst case for full testing. The field strength of spurious radiation emission was measured as EUT stand-up position (H mode) and lie down position (E1, E2 mode) for Bluetooth Transmitter for channel Low, Mid and High the worst case E2 position was reported.

Channel Low: channel 1 at 2402MHz Channel Mid: channel 39 at 2441MHz Channel High: channel 78 at 2480MHz

In comparison with BR and EDR mode, emission carried out by EDR is chosen as the most representative measurement to perform measurement of radiated spurious emission pursuant to Part 15C.Modulation, EDR, is selected to be performed for 100 kHz Bandwidth Band Edge, Conducted Spurious Emission, Frequency Separation, Number of hopping frequency due to its characteristics of wider bandwidth.

Data type being used to conduct the measurement: DH1/DH3/DH5 (GFSK) with 1Mbps 2DH1/2DH3/2DH5 (/4 DQPSK) with 2Mbps 3DH1/3DH3/3DH5 (8DPSK) with 3Mbps

Model no, PM-0490-BV, and Model no PM-0480-BV share the equivalently identical enclosure, material of coating, I/O function, PCB board, display, and power source. In addition, PM-0490-BV, and Model no PM-0480-BV implement the same Bluetooth chipset/module with the same antenna that operates with the same transmitted power level. Hence, this given test report contains the identical test results that inherent from PM-0480-BV.

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5. MEASUREMENT UNCERTAINTY

Test Items	Uncertainty
AC Power Line Conducted Emission	+/- 2.586 dB
Peak Output Power	+/- 1.55 dB
20dB Bandwidth	+/- 123.36 Hz
100 KHz Bandwidth Of Frequency Band Edges	+/- 1.55 dB
Frequency Separation	+/- 123.36 Hz
Number of hopping frequency	+/- 123.36 Hz
Time of Occupancy	+/- 123.36 Hz
Temperature	+/- 0.8 °C
Humidity	+/- 4.7 %
DC / AC Power Source	DC= +/- 1%, AC= +/- 0.2%

Radiated Spurious Emission:

	30MHz - 180MHz: +/- 3.37dB
Measurement uncertainty (Polarization : Vertical)	180MHz -417MHz: +/- 3.19dB
	0.417GHz-1GHz: +/- 3.19dB
(Totalization: Vertical)	1GHz - 18GHz: +/- 4.04dB
	18GHz - 40GHz: +/- 4.04dB

	30MHz - 167MHz: +/- 4.22dB		
Measurement uncertainty	167MHz -500MHz: +/- 3.44dB		
(Polarization : Horizontal)	0.5GHz-1GHz: +/- 3.39dB		
	1GHz - 18GHz: +/- 4.08dB		
	18GHz - 40GHz: +/- 4.08dB		

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

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6. CONDUCTED EMISSION TEST

6.1. Standard Applicable

According to §15.207, frequency within 150 kHz to 30MHz shall not exceed the limit table as below.

Frequency range	Limits dB(uV)		
MHz	Quasi-peak	Average	
0.15 to 0.50	66 to 56	56 to 46	
0.50 to 5	56	46	
5 to 30	60	50	

Note

6.2. Measurement Equipment Used:

Conducted Emission Test Site									
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.				
TYPE		NUMBER	NUMBER	CAL.					
EMI Test Receiver	R&S	ESCI7	100759	05/20/2011	05/19/2013				
EMI Receiver	R&S	ESCS 30	828985/004	09/23/2012	09/22/2013				
LISN	Rolf-Heine	NNB-2/16Z	99012	03/23/2013	03/22/2014				
LISN	FCC	FCC-LISN-50/250-25-2-01	04034	03/23/2013	03/22/2014				
Coaxial Cables	N/A	WK CE Cable	N/A	01/05/2013	01/04/2014				

6.3. EUT Setup

- 1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.4:2009 & ANSI 63.10:2009.
- 2.The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
- 3. The LISN was connected with 120Vac/60Hz power source.

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^{1.} The lower limit shall apply at the transition frequencies

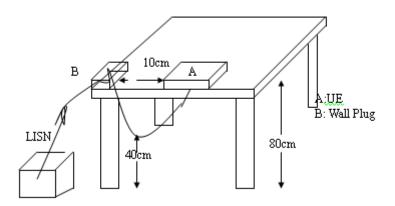
^{2.} The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.



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6.4. Test SET-UP (Block Diagram of Configuration)



6.5. Measurement Procedure

- 1. The EUT was placed on a table which is 0.8m above ground plane.
- 2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
- 3. Repeat above procedures until all frequency measured were complete.

Measurement Result

Note: Refer to next page for measurement data and plots.

Note2: The * reveals the worst-case results that closet to the limit

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Temperature:

60%

Humidity:

AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	Operation mode			Test Date:	Apr. 24, 2013
Temperature:	26	Humidity:	60 %	Test By:	Marcus

Site ConductionRoom

Limit: FCC Class B Conduction(QP)

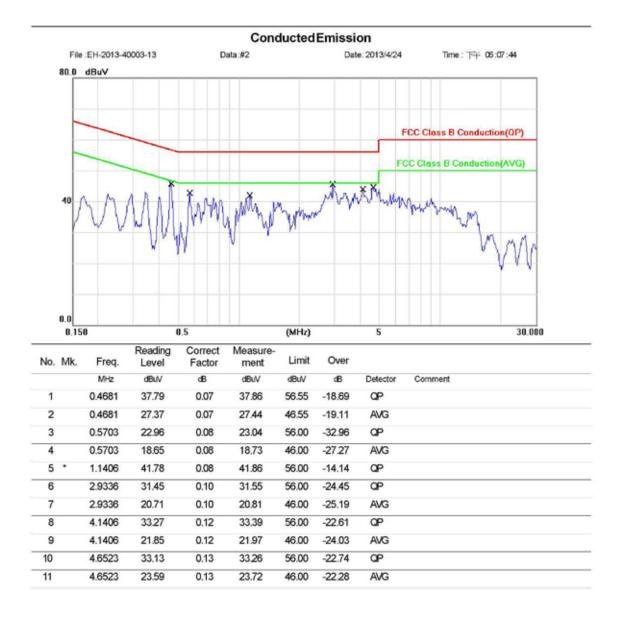
PDA Phone

M/N: C1905

Note:

Phase: L1
Power: AC 120V/60Hz

Distance: Mode: Operationmode



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Site ConductionRoom

Limit: FCC Class B Conduction(QP)

Reading

Correct Measure-

EUT: PDA Phone M/N: C1905

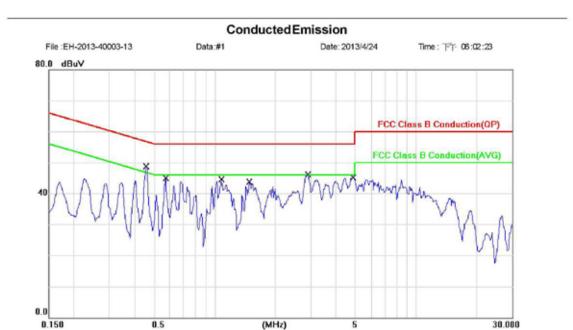
Note:

Phase: AC 120V/60Hz Power:

Distance:

Mode: Operationmode

Temperature: 26 0 Humidity:



No.	Mk.	Freq.	Level	Factor	ment	Limit	Over		
		MHz	dBuV	dΒ	dBuV	dBuV	ďΒ	Detector	Comment
1		0.4586	47.21	0.12	47.33	56.72	-9.39	QP.	
2	•	0.4586	41.62	0.12	41.74	46.72	-4.98	AVG	
3		0.5703	42.78	0.14	42.92	56.00	-13.08	QP	
4		0.5703	37.22	0.14	37.36	46.00	-8.64	AVG	
5		1.0781	38.71	0.16	38.87	56.00	-17.13	QP.	
6		1.0781	30.31	0.16	30.47	46.00	-15.53	AVG	
7		1.4805	38.88	0.16	39.04	56.00	-16.96	QP	
8		1.4805	29.48	0.16	29.64	46.00	-16.36	AVG	
9		2.9141	40.99	0.17	41.16	56.00	-14.84	QP	
10		2.9141	31.72	0.17	31.89	46.00	-14.11	AVG	
11		4.8711	38.96	0.20	39.16	56.00	-16.84	QP	
12		4.8711	29.23	0.20	29.43	46.00	-16.57	AVG	

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PEAK OUTPUT POWER MEASUREMENT

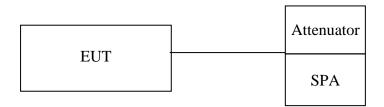
7.1. Standard Applicable

According to §15.247(b)(1), for frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels, The Limit: 1Watt. For all other frequency hopping systems in the 2400 – 2483.5MHz band: The Limit: 0.125 Watts.

7.2. Measurement Equipment Used

Conducted Emission Test Site								
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.			
TYPE		NUMBER	NUMBER	CAL.				
Power Sensor	Anritsu	ML2495A	1005007	02/08/2012	02/07/2014			
Power Meter	Anritsu	MA2411B	917032	02/08/2012	02/07/2014			
Spectrum Analyzer	Agilent	E4446A	MY51100003	04/15/2013	04/14/2014			
Spectrum Analyzer	Agilent	E4440A	MY45304525	03/15/2013	03/14/2014			
DC Block	Mini-Circuits	BLK-18-S+	1	02/28/2013	02/27/2014			
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA	N/A	01/05/2013	01/04/2014			
Attenuator	Mini-Circuit	BW-S10W2+	002	02/28/2013	02/27/2014			
Splitter	Agilent	11636B	N/A	02/28/2013	02/27/2014			

7.3. Test Set-up:



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7.4. Measurement Procedure:

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter or spectrum. (Max Hold, Detector = Peak, RBW >= 20dB bandwidth)
- 3. Record the max. reading.
- 4. Repeat above procedures until all default test channel is completed.

NOTE: cable loss as 4.2dB that offsets in the spectrum

7.5. Measurement Result

1M BR mode:

Frequency (MHz)	Reading Power (dBm)	Output Power (dBm)	Output Power (W)	Limit (W)
2402.00	8.23	8.23	0.00665	1
2441.00	8.27	8.27	0.00671	1
2480.00	7.82	7.82	0.00605	1

2M EDR mode:

Frequency (MHz)	Reading Power (dBm)	Output Power (dBm)	Output Power (W)	Limit (W)
2402.00	9.10	9.10	0.00813	0.125
2441.00	9.12	9.12	0.00817	0.125
2480.00	8.71	8.71	0.00743	0.125

3M EDR mode:

Frequency (MHz)	Reading Power (dBm)	Output Power (dBm)	Output Power (W)	Limit (W)
2402.00	9.15	9.15	0.00822	0.125
2441.00	9.22	9.22	0.00836	0.125
2480.00	8.76	8.76	0.00752	0.125

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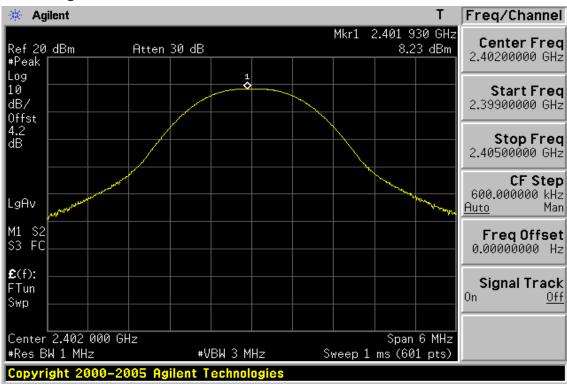
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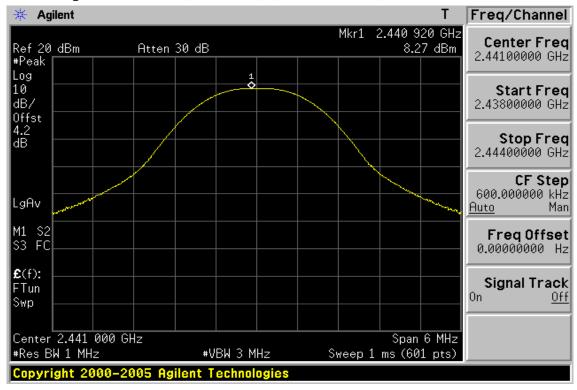
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Peak Power Output Data Plot (CH Low) (1M BR mode)



Peak Power Output Data Plot (CH Mid) (1M BR mode)



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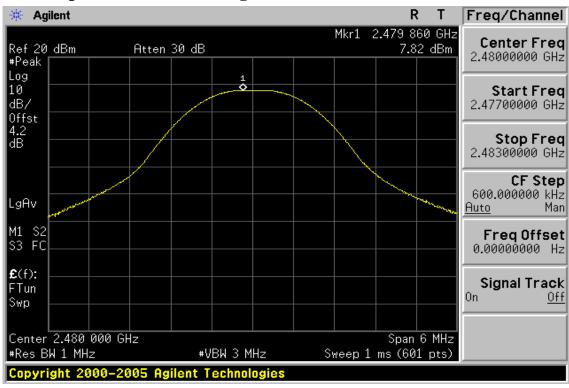
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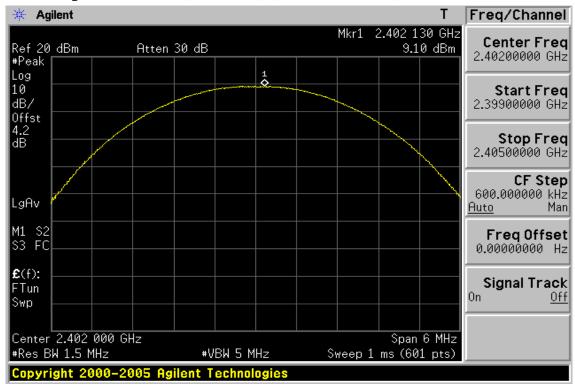
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Peak Power Output Data Plot (CH High) (1M BR mode)



Peak Power Output Data Plot (CH Low) (2M EDR mode)



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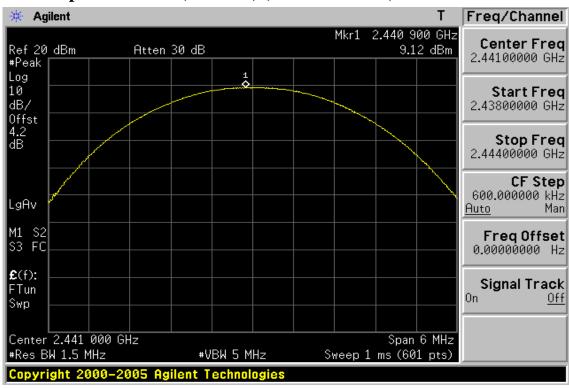
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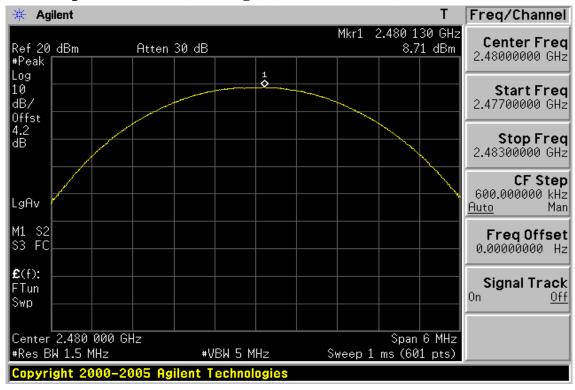
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Peak Power Output Data Plot (CH Mid) (2M EDR mode)



Peak Power Output Data Plot (CH High) (2M EDR mode)



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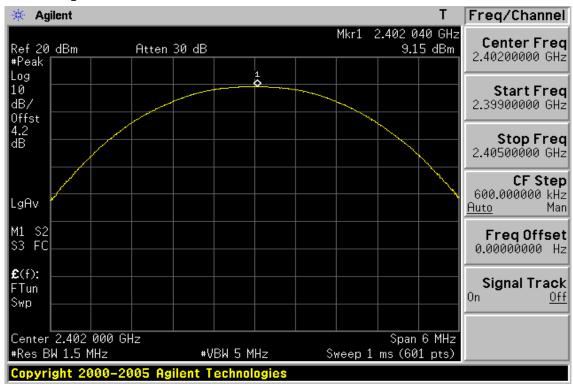
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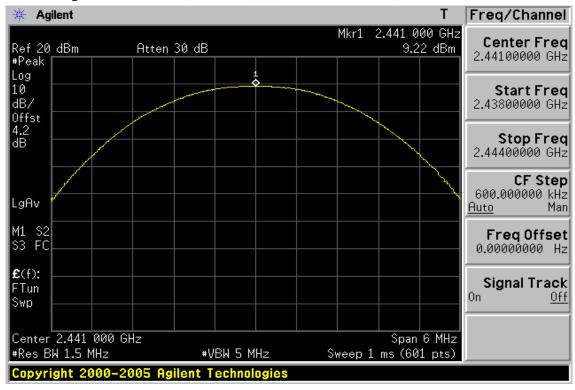
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Peak Power Output Data Plot (CH Low) (3M EDR mode)



Peak Power Output Data Plot (CH Mid) (3M EDR mode)



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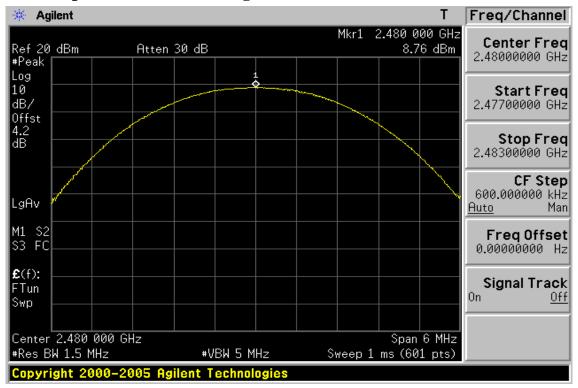
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Peak Power Output Data Plot (CH High) (3M EDR mode)



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8. 20dB BANDWIDTH

8.1. Standard Applicable

According to §15.247(a)(1), for frequency hopping systems operating in the 2400MHz-2483.5 MHz no limit for 20dB bandwidth.

8.2. Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.
TYPE		NUMBER	NUMBER	CAL.	
Power Sensor	Anritsu	ML2495A	1005007	02/08/2012	02/07/2014
Power Meter	Anritsu	MA2411B	917032	02/08/2012	02/07/2014
Spectrum Analyzer	Agilent	E4446A	MY51100003	04/15/2013	04/14/2014
Spectrum Analyzer	Agilent	E4440A	MY45304525	03/15/2013	03/14/2014
DC Block	Mini-Circuits	BLK-18-S+	1	02/28/2013	02/27/2014
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA	N/A	01/05/2013	01/04/2014
Attenuator	Mini-Circuit	BW-S10W2+	002	02/28/2013	02/27/2014
Splitter	Agilent	11636B	N/A	02/28/2013	02/27/2014

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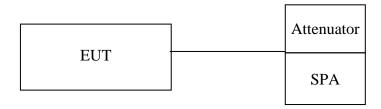
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8.3. Test Set-up



8.4. Measurement Procedure:

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- 3. Set the spectrum analyzer as RBW=10 kHz (1 % of 20 dB Bandwidth.), VBW = 30 kHz, Span= 3MHz, Sweep=auto, Detector = Peak, and Max hold for 20dB Bandwidth test.
- 4. Mark the peak frequency and –20dB (upper and lower) frequency and Turn on the max reading.
- 5. Repeat above procedures until all test default channel is completed

NOTE: cable loss as 4.2dB that offsets in the spectrum

NOTE2: For the plot of bandwidth measurement, the marker of the 20dB BW is arrow-mark

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8.5. Measurement Result:

20dB Bandwidth:

1M BR mode:

СН	Bandwidth	
	(MHz)	
Low	0.925496	
Mid	0.925444	
High	0.925587	

2M EDR mode:

СН	Bandwidth	2/3 Bandwidth
	(MHz)	(MHz)
Low	1.289	0.859
Mid	1.288	0.859
High	1.290	0.860

3M EDR mode:

СН	Bandwidth	2/3 Bandwidth	
	(MHz)	(MHz)	
Lower	1.270	0.847	
Mid	1.271	0.847	
High	1.272	0.848	

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20dB Band Width Test Data CH-Low (1M BR mode)



20dB Band Width Test Data CH-Mid (1M BR mode)



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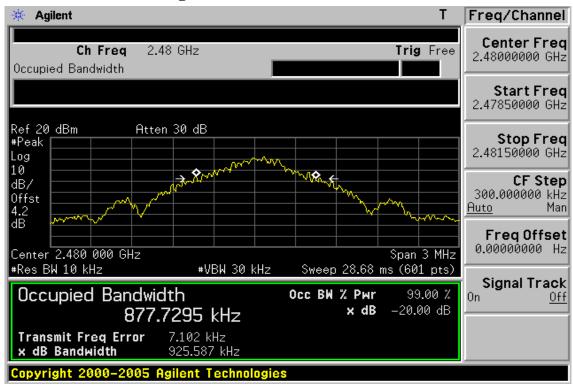
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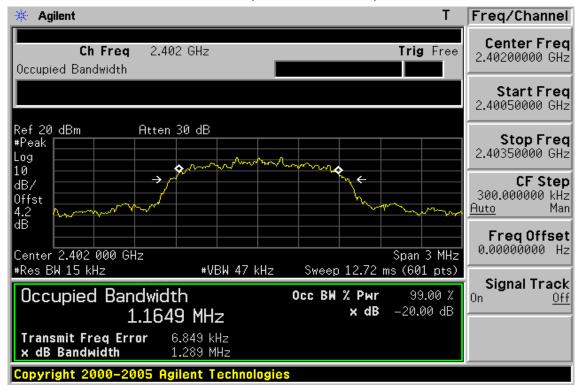
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20dB Width Test Data CH-High (1M BR mode)



20dB Band Width Test Data CH-Low (2M EDR mode)



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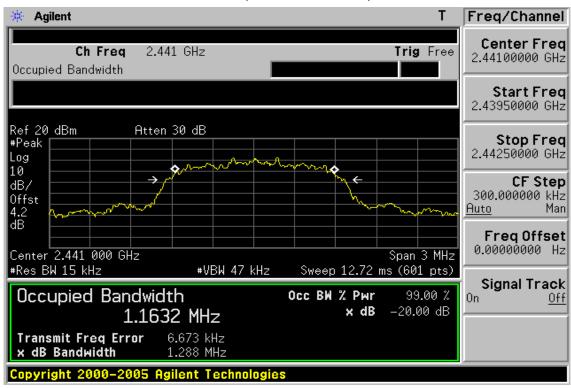
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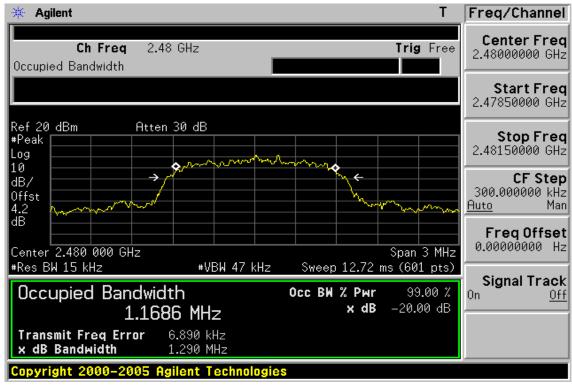
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20dB Band Width Test Data CH-Mid (2M EDR mode)



20dB Band Width Test Data CH-High (2M EDR mode)



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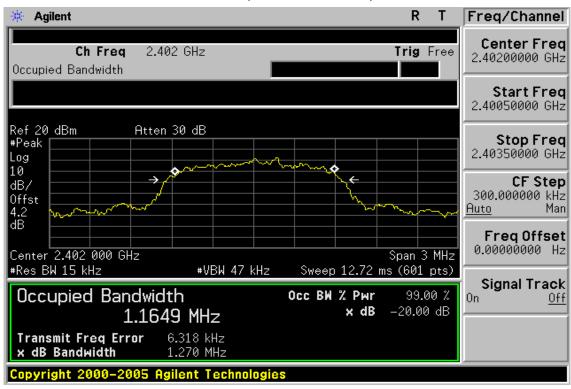
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20dB Band Width Test Data CH-Low (3M EDR mode)



20dB Band Width Test Data CH-Mid (3M EDR mode)



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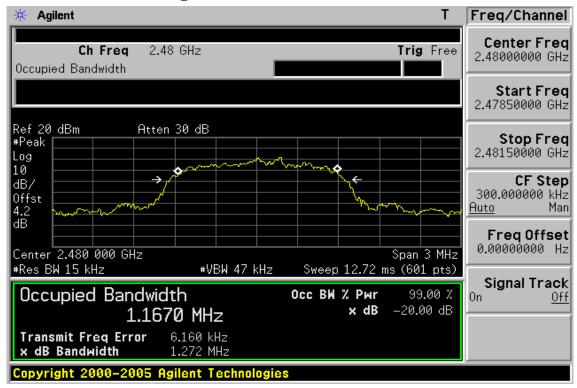
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20dB Width Test Data CH-High (3M EDR mode)



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9. BAND EDGES EMISSION MEASUREMENT

9.1. Standard Applicable

According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in15.209(a).

9.2. Measurement Equipment Used

9.2.1. Conducted Emission at antenna port:

Conducted Emission Test Site											
EQUIPMENT MFR		MODEL SERIAL		LAST	CAL DUE.						
TYPE		NUMBER	NUMBER	CAL.							
Spectrum Analyzer	Agilent	E4446A	MY51100003	04/15/2013	04/14/2014						
Spectrum Analyzer	Agilent	E4440A	MY45304525	03/15/2013	03/14/2014						
DC Block	Mini-Circuits	BLK-18-S+	1	02/28/2013	02/27/2014						
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA	N/A	01/05/2013	01/04/2014						
Attenuator	Mini-Circuit	BW-S10W2+	002	02/28/2013	02/27/2014						

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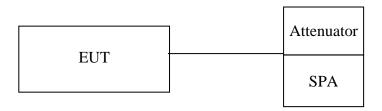


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9.3. Test SET-UP:

9.3.1. Conducted Emission at antenna port:



9.4. Measurement Procedure

100 kHz BANDWIDTH OF BAND EDGES:

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- 3. Set center frequency of spectrum analyzer = operating frequency.
- 4. Set the spectrum analyzer as RBW, VBW=300 kHz, Sweep = auto
- 5. Mark Peak, 2.390GHz and 2.4835GHz and record the max. level.
- 6. Repeat above procedures until all frequency measured were complete.

Out-Of-Band EMISSION

- 1. To connect Antenna Port of EUT to Spectrum.
- 2. Set RBW = 100K & VBW = 300K on Spectrum.
- 3. Sweep the frequency to determine spurious emission as seen on spectrum from span of 30MHz to 3G, 3G to 8G, 8G to 13G, 13G to 18G and 18G to 26.5GHz
- 4. Via Software, combine 5 spans of frequency range into two plots containing the range of 30MHz to 3GHz, and 3GHz to 26.5GHz.

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9.5. Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

Where	FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
	RA = Reading Amplitude	AG = Amplifier Gain
	AF = Antenna Factor	

9.6. Measurement Result -1 Out-Of-Band EMISSION:

Note: Refer to next page spectrum analyzer data chart and tabular data sheets.

NOTE: cable loss as 4.2dB that offsets in the spectrum

NOTE: the occurrence of the spike on the conducted emission is the signal of the fundamental emission.

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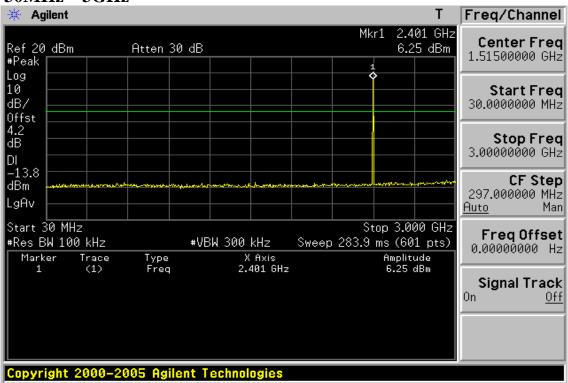


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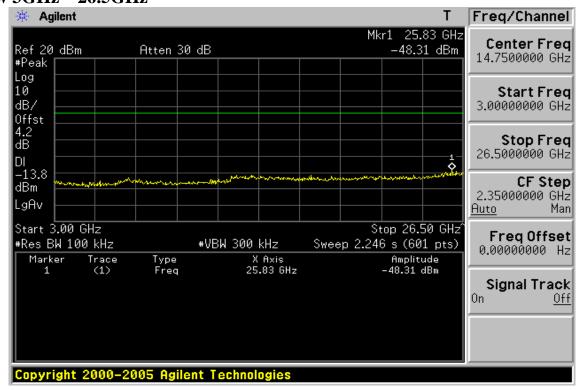
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9.7 Measurement Result -1 Conducted Spurious Emission Measurement Result (Worst: EDR mode)

Ch Low 30MHz - 3GHz



Ch Low 3GHz - 26.5GHz



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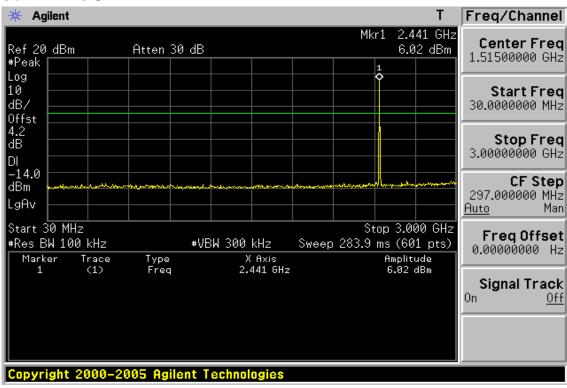
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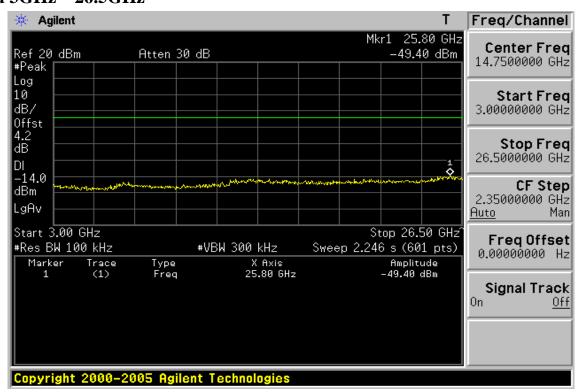
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Ch Mid 30MHz - 3GHz



Ch Mid 3GHz – 26.5GHz



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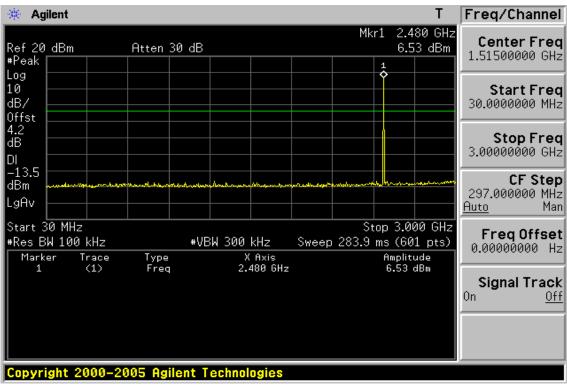
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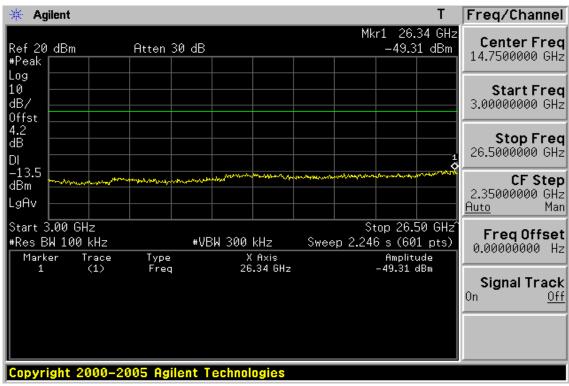
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Ch High 30MHz – 3GHz



Ch High 3GHz – 26.5GHz



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Tabular Results:

Out of Band emission at antenna terminals – Bluetooth (EDR- The Worst)

Fundamental Frequency 2412 MHz Engineer :Nick

Operation Mode :TX Low

Freq. (MHz)	Note F/H/E/S	Reading Limit dBm dBm		Safe Margin dB
2401.00	Ref	6.25		
<30	S		-13.80	
30-1000	S		-13.80	
4804.00	Н		-13.80	
7206.00	Н		-13.80	
9608.00	Н		-13.80	
12010.00	Н		-13.80	
14412.00	Н		-13.80	
16814.00	Н		-13.80	
19216.00	Н		-13.80	
21618.00	Н		-13.80	
24020.00	Н		-13.80	
25830.00	S	-48.31	-13.80	34.51

"H": denotes Harmonic Frequency. "S": denotes Spurious Frequency. Note:

"---": denotes Noise Floor. Ref: Reference Signal

Note2: Limit = Ref (the highest emission of the fundamental) – 20dBm

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Fundamental Frequency Engineer 2441 MHz :Nick

Operation Mode :TX Mid

Freq. (MHz)	Note F/H/E/S	Reading dBm	Limit dBm	Safe Margin dB
2441.00	Ref	6.02		
<30	S		-14.00	
30-1000	S		-14.00	
4882.00	Н		-14.00	
7323.00	Н		-14.00	
9764.00	Н		-14.00	
12205.00	Н		-14.00	
14646.00	Н		-14.00	
17087.00	Н		-14.00	
21969.00	Н		-14.00	
24410.00	Н		-14.00	
24370.00	Н		-14.00	
25800.00	S	-49.40	-14.00	35.40

"H": denotes Harmonic Frequency. "S": denotes Spurious Frequency. Note:

"---": denotes Noise Floor.

Note2: Limit = Ref (the highest emission of the fundamental) – 20dBm

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Fundamental Frequency 2480 MHz Engineer :Nick Operation Mode :TX High

Freq. (MHz)	Note F/H/E/S	Reading Limit dBm dBm		Safe Margin dB
2480.00	Ref	6.54		
<30	S		-13.50	
30-1000	S		-13.50	
4960.00	Н		-13.50	
7440.00	Н		-13.50	
9920.00	Н		-13.50	
12400.00	Н		-13.50	
14880.00	Н		-13.50	
17360.00	Н		-13.50	
19840.00	Н		-13.50	
22320.00	Н		-13.50	
24800.00	Н		-13.50	
26340.00	S	-49.31	-13.50	35.81

"H": denotes Harmonic Frequency. "S": denotes Spurious Frequency. Note:

"---": denotes Noise Floor.

Note2: Limit = Ref (the highest emission of the fundamental) – 20dBm

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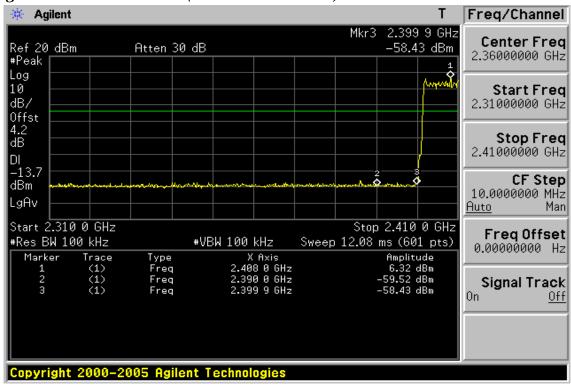
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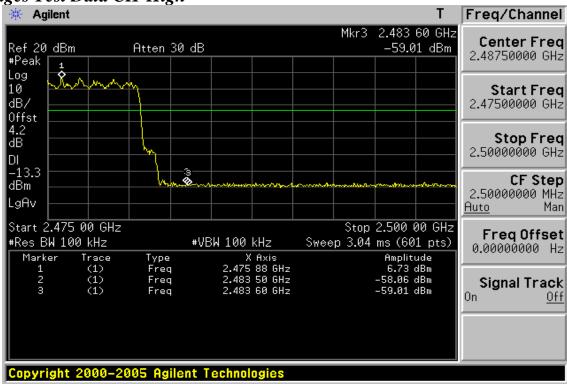
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9.7 Measurement Result -2 100 kHz BANDWIDTH OF BNAD EDGE: Band Edges Test Data CH-Low (Worst: EDR mode)



Band Edges Test Data CH-High



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Bluetooth EDR - The Worst

Frequency (GHz)	Results (dBm)	Ref (dBm)	Limit (dBm)	Verdict
2.3999	-58.43	6.32	-13.70	Pass
2.4836	-59.01	6.73	-13.30	Pass

Note: Limit = Ref (The highest level of emission) dBm – 20dBm

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10. SPURIOUS RADIATED EMISSION TEST

10.1. Standard Applicable

According to §15.247(d),

Emission at antenna port:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

Radiated Spurious Emission

Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c)).

And according to §15.33(a) (1), for an intentional radiator operates below 10GHz, the frequency range of measurements: to the tenth harmonic of the highest fundamental frequency or to 40GHz, whichever is lower.

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10.2. Measurement Equipment Used:

10.2.1. Radiated emission:

	966 Chamber											
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.							
TYPE		NUMBER	NUMBER	CAL.								
EMI Test Receiver	R&S	ESCI7	100759	05/20/2011	05/19/2013							
Spectrum Analyzer	Agilent	E4446A	MY51100003	04/15/2013	04/14/2014							
EXA Spectrum Analyzer	Agilent	N9010A	MY50420195	02/06/2013	02/07/2014							
Spectrum Analyzer	R&S	FSV-30	101398	10/18/2011	10/17/2013							
Bilog Antenna	SCHWAZBECK	VULB9168	378	01/10/2012	01/09/2014							
Horn antenna	ETS.LINDGREN	3117	123995	05/19/2011	05/18/2013							
Horn Antenna	Schwarzbeck	BBHA9170	185	07/11/2011	07/10/2013							
Pre-Amplifier	Agilent	8447D	2944A07676	01/04/2013	01/03/2014							
Pre-Amplifier	EMC Instruments Corp.	EMC0126530	980038	01/04/2013	01/03/2014							
Filter 2400-2483.5 MHz	EWT	EWT-14-0166	M2	02/28/2013	02/28/2014							
Attenuator	Mini-Circuit	BW-S10W2+	004	02/28/2013	02/27/2014							
Turn Table	HD	DT420	N/A	N.C.R	N.C.R							
Antenna Tower	HD	MA240-N	240/657	N.C.R	N.C.R							
Controller	HD	HD100	N/A	N.C.R	N.C.R							
Low Loss Cable	Huber Suhner	966_Rx	9	01/04/2013	01/03/2014							
3m Site NSA	SGS	966 chamber	N/A	07/15/2012	07/14/2013							

NOTE: N.C.R refers to Not Calibrated Required.

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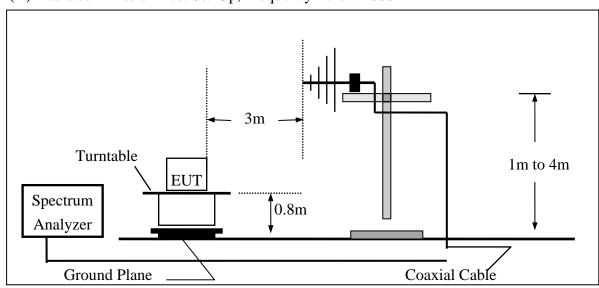
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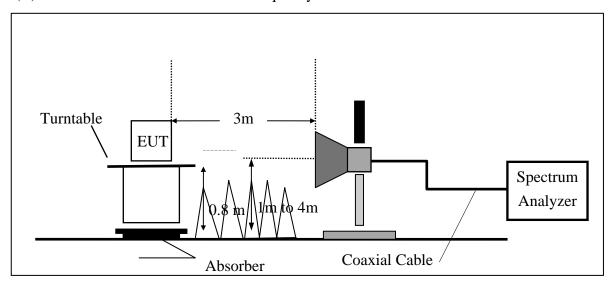
10.3. Test SET-UP:

10.3.1. Radiated emission:

(A) Radiated Emission Test Set-Up, Frequency Below 1000MHz



(B) Radiated Emission Test Set-UP Frequency Over 1 GHz



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10.4. Measurement Procedure:

Radiated Emission:

- 1. The EUT was placed on a turn table which is 0.8m above ground plane.
- 2. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
- 3. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
- 4. When measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.
- 5. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
- 6. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
- 7. Repeat above procedures until all frequency of the interest measured were complete.

Auxiliary Procedure (Setting on Spectrum to capture the reading of emission level):

Span = wide enough to fully capture the emission being measured

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

 $VBW \ge RBW$

Sweep = auto

Detector function = peak

Trace = max hold

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10.5. Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CL - AG

Where	FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
	RA = Reading Amplitude	AG = Amplifier Gain
	AF = Antenna Factor	

Remark:

- 1. The limit of the emission level is expressed in dBuV/m, which converts 20*log(uV/m)
- 2. Factor(dB) = Antenna Factor (dB μ V/m) + Cable Loss(dB) Pre Amplifier Gain(dB)

10.6. Measurement Result:

Note: Refer to next page spectrum analyzer data chart and tabular data sheets.

Note: For measurement plot of radiation revealing the compliance of 15.209, please refer to Appendix I.

Note: For the tabular table as presents below, "F": denotes Fundamental Frequency.; "H": denotes Harmonic Frequency. "E": denotes Band Edge Frequency.; "S": denotes Spurious Frequency.

"---": denotes Noise Floor

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EUT Pol.

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:HORIZONTAL

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10.6.1 Radiated Emission – Band Edge: (Worst :EDR mode)

:E2 Plan

Operation Band :EDR **Test Date** :2013-04-24 Fundamental Frequency :2402 MHz Temp./Humi. :23deg_C/52RH

Operation Mode :Bandedge LOW Engineer :Louis

EUT Pol. Measurement Antenna Pol. :E2 Plan :VERTICAL

Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Lev	vel	FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dΒμV	dB	dBμV/m	dBμV/m	dB
2390.00	E	Average	30.38	2.12	32.50	54.00	-21.50
2390.00	E	Peak	42.74	2.12	44.86	74.00	-29.14
Operation Band Fundamental Frequency Operation Mode		:EDR :2402 MHz :Bandedge I		Test Date Temp./Humi. Engineer		:2013-04-24 :23deg_C/52 :Louis	

Measurement Antenna Pol.

Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin	
		Mode	Reading Level		FS	@3m		
MHz	F/H/E/S	PK/QP/AV	dΒμV	dB	dBμV/m	dBμV/m	dB	
2390.00	E	Average	30.17	2.74	32.91	54.00	-21.09	
2390.00	E	Peak	42.64	2.74	45.38	74.00	-28.62	

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Note

Detector

Freq.

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Limit

Margin

Operation Band :EDR Test Date :2013-04-24 Fundamental Frequency :2480 MHz Temp./Humi. :23deg_C/52RH

Operation Mode :Bandedge HIGH Engineer :Louis

EUT Pol. :E2 Plan Measurement Antenna Pol. :VERTICAL

Spectrum

MHz	F/H/E/S	Mode PK/QP/AV	Reading Lev	vel dB	FS dBµV/m	@3m dBμV/m	dB
2483.50	Е	Average	31.60	2.53	34.13	54.00	-19.87
2483.50	E	Peak	46.41	2.53	48.94	74.00	-25.06
Operation Ba Fundamental Operation Mo EUT Pol.	Frequency	:EDR :2480 MHz :Bandedge I :E2 Plan	HIGH	Test Date Temp./Humi. Engineer Measurement A	.ntenna Pol.	:2013-04-24 :23deg_C/52 :Louis :HORIZON	2RH
Freq.	Note	Detector Mode	Spectrum Reading Lev	Factor vel	Actual FS	Limit @3m	Margin

Factor

Actual

MHz	F/H/E/S	PK/QP/AV	dΒμV	dB	dBμV/m	dBμV/m	dB
2483.50	E	Average	34.17	3.56	37.73	54.00	-16.27
2483.50	E	Peak	50.53	3.56	54.09	74.00	-19.91

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10.6.2 Radiated Spurious Emission Measurement Result (worst case EDR mode)

Operation Ba Fundamental Operation Mo EUT Pol.	nd Frequency	:EDR :2402 MHz :TX LOW :E2 Plan	Ten Eng	t Date np./Humi. gineer	antenna Pol.	:2013-04-03 :23deg_C/52 :Louis :VERTICAL	
Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dΒμV	dB	dBμV/m	dBμV/m	dB
40.67	S	Peak	42.64	-13.48	29.16	40.00	-10.84
157.07	S	Peak	29.11	-12.29	16.82	43.50	-26.68
343.31	S	Peak	28.03	-11.76	16.27	46.00	-29.73
458.74	S	Peak	27.78	-9.98	17.80	46.00	-28.20
612.97	S	Peak	28.21	-7.28	20.93	46.00	-25.07
897.18	S	Peak	35.11	-2.87	32.24	46.00	-13.76
4804.00	Н	Average	25.79	6.99	32.78	54.00	-21.22
4804.00	Н	Peak	41.03	6.99	48.02	74.00	-25.98
7206.00	Н						
9608.00	Н						
12010.00	Н						
14412.00	Н						
16814.00	Н						
19216.00	Н						
21618.00	Н						

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Operation Ba Fundamental Operation Mo EUT Pol.	Frequency	:EDR :2402 MHz :TX LOW :E2 Plan] I	Test Date Temp./Humi. Engineer Measurement A	ntenna Pol.	:2013-04-03 :23deg_C/52 :Louis :HORIZON	
Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Leve	1	FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dΒμV	dB	dBμV/m	dBμV/m	dB
46.49	S	Peak	30.50	-13.80	16.70	40.00	-23.30
162.89	S	Peak	26.92	-12.52	14.40	43.50	-29.10
342.34	S	Peak	28.68	-11.78	16.90	46.00	-29.10
524.70	S	Peak	27.39	-9.11	18.28	46.00	-27.72
698.33	S	Peak	27.12	-5.77	21.35	46.00	-24.65
860.32	S	Peak	27.36	-3.52	23.84	46.00	-22.16
4804.00	Н	Average	25.98	7.03	33.01	54.00	-20.99
4804.00	Н	Peak	38.15	7.03	45.18	74.00	-28.82
7206.00	Н						
9608.00	Н						
12010.00	Н						
14412.00	Н						
16814.00	Н						
19216.00	Н						
21618.00	Н						
24020.00	Н						

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Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dΒμV	dB	dBμV/m	dBμV/m	dB
40.67	S	Peak	43.23	-13.48	29.75	40.00	-10.25
157.07	S	Peak	29.30	-12.29	17.01	43.50	-26.49
346.22	S	Peak	26.70	-11.73	14.97	46.00	-31.03
577.08	S	Peak	27.50	-8.05	19.45	46.00	-26.55
714.82	S	Peak	27.70	-5.51	22.19	46.00	-23.81
897.18	S	Peak	32.94	-2.87	30.07	46.00	-15.93
4882.00	Н	Average	25.95	7.16	33.11	54.00	-20.89
4882.00	Н	Peak	39.07	7.16	46.23	74.00	-27.77
7323.00	Н						
9764.00	Н						
12205.00	Н						
14646.00	Н						
17087.00	Н						
19528.00	Н						
21969.00	Н						
24410.00	Н						

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Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dΒμV	dB	dBμV/m	dBμV/m	dB
39.70	S	Peak	31.31	-13.47	17.84	40.00	-22.16
116.33	S	Peak	29.75	-14.98	14.77	43.50	-28.73
345.25	S	Peak	28.09	-11.73	16.36	46.00	-29.64
579.02	S	Peak	29.04	-8.01	21.03	46.00	-24.97
770.11	S	Peak	27.46	-4.61	22.85	46.00	-23.15
897.18	S	Peak	28.75	-2.87	25.88	46.00	-20.12
4882.00	Н	Average	25.65	7.10	32.75	54.00	-21.25
4882.00	Н	Peak	38.11	7.10	45.21	74.00	-28.79
7323.00	Н						
9764.00	Н						
12205.00	Н						
14646.00	Н						
17087.00	Н						
19528.00	Н						
21969.00	Н						
24410.00	Н						

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Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dΒμV	dB	dBμV/m	dBμV/m	dB
39.70	S	Peak	42.06	-13.47	28.59	40.00	-11.41
114.39	S	Peak	31.91	-15.22	16.69	43.50	-26.81
343.31	S	Peak	27.54	-11.76	15.78	46.00	-30.22
563.50	S	Peak	28.57	-8.31	20.26	46.00	-25.74
776.90	S	Peak	27.64	-4.52	23.12	46.00	-22.88
897.18	S	Peak	33.44	-2.87	30.57	46.00	-15.43
4960.00	Н	Average	26.02	7.17	33.19	54.00	-20.81
4960.00	Н	Peak	37.24	7.17	44.41	74.00	-29.59
7440.00	Н						
9920.00	Н						
12400.00	Н						
14880.00	Н						
17360.00	Н						
19840.00	Н						
22320.00	Н						
24800.00	Н						

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Operation Ba Fundamental Operation Mo EUT Pol.	Frequency	:EDR :2480 MHz :TX HIGH :E2 Plan	T E	est Date emp./Humi. Ingineer Ieasurement A	ntenna Pol.	:2013-04-03 :23deg_C/52 :Louis :HORIZON	
Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dΒμV	dB	dBμV/m	dBμV/m	dB
39.70	S	Peak	29.69	-13.47	16.22	40.00	-23.78
160.95	S	Peak	26.94	-12.36	14.58	43.50	-28.92
336.52	S	Peak	29.10	-11.83	17.27	46.00	-28.73
435.46	S	Peak	29.90	-10.31	19.59	46.00	-26.41
721.61	S	Peak	27.98	-5.40	22.58	46.00	-23.42
897.18	S	Peak	29.33	-2.87	26.46	46.00	-19.54
4960.00	Н	Average	25.95	7.02	32.97	54.00	-21.03
4960.00	Н	Peak	37.12	7.02	44.14	74.00	-29.86
7440.00	Н						
9920.00	Н						
12400.00	Н						
14880.00	Н						
17360.00	Н						
19840.00	Н						
22320.00	Н						
24800.00	Н						

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11. FREQUENCY SEPARATION

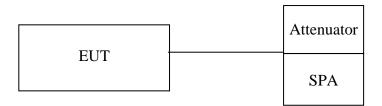
11.1. Standard Applicable

According to §15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25 kHz or the 2/3*20dB bandwidth of the hopping channel, whichever is greater.

11.2. Measurement Equipment Used:

	Conducted Emission Test Site							
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.			
TYPE		NUMBER	NUMBER	CAL.				
Spectrum Analyzer	Agilent	E4446A	MY51100003	04/15/2013	04/14/2014			
Spectrum Analyzer	Agilent	E4440A	MY45304525	03/15/2013	03/14/2014			
DC Block	Mini-Circuits	BLK-18-S+	1	02/28/2013	02/27/2014			
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA	N/A	01/05/2013	01/04/2014			
Attenuator	Mini-Circuit	BW-S10W2+	002	02/28/2013	02/27/2014			

11.3. Test Set-up:



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11.4. Measurement Procedure:

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- 3. Set center frequency of spectrum analyzer = middle of hopping channel.
- 4. Set the spectrum analyzer as RBW, VBW=100 kHz, Adjust Span to 5MHz, Sweep = auto.
- 5. Max hold. Mark 3 Peaks of hopping channel and record the 3 peaks frequency.

11.5. Measurement Result:

Channel separation (MHz)	Limit	Result
1	>=25 kHz or 2/3 times 20dB bandwidth	PASS

Note: Refer to next page for plots.

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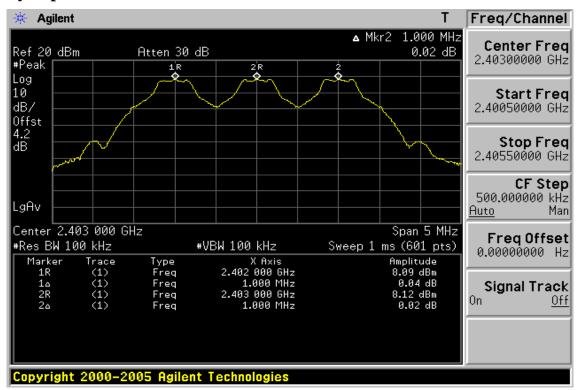
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Frequency Separation Test Data



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12. NUMBER OF HOPPING FREQUENCY

12.1. Standard Applicable

According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands shall use at least 15 hopping frequencies.

12.2. Measurement Equipment Used:

	Conducted Emission Test Site							
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.			
TYPE		NUMBER	NUMBER	CAL.				
Spectrum Analyzer	Agilent	E4446A	MY51100003	04/15/2013	04/14/2014			
Spectrum Analyzer	Agilent	E4440A	MY45304525	03/15/2013	03/14/2014			
DC Block	Mini-Circuits	BLK-18-S+	1	02/28/2013	02/27/2014			
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA	N/A	01/05/2013	01/04/2014			
Attenuator	Mini-Circuit	BW-S10W2+	002	02/28/2013	02/27/2014			

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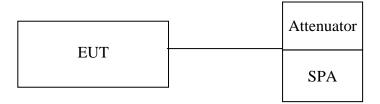
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12.3. Test Set-up:



12.4. Measurement Procedure:

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- 3. Set spectrum analyzer Start=2400MHz, Stop = 2483.5MHz, Sweep = auto.
- 4. Set the spectrum analyzer as RBW=430 kHz, VBW=1.5MHz., Detector = Peak
- 5. Max hold, view and count how many channel in the band.

12.5. Measurement Result:

Note: Refer to next page for plots.

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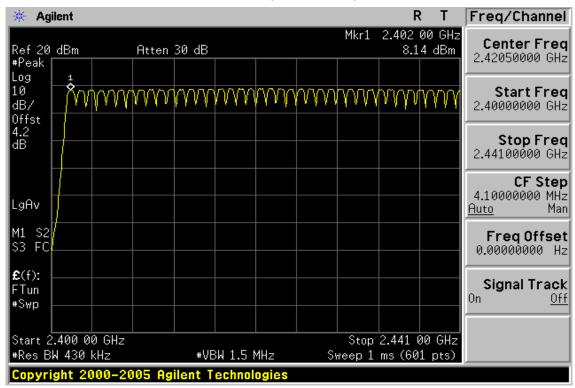


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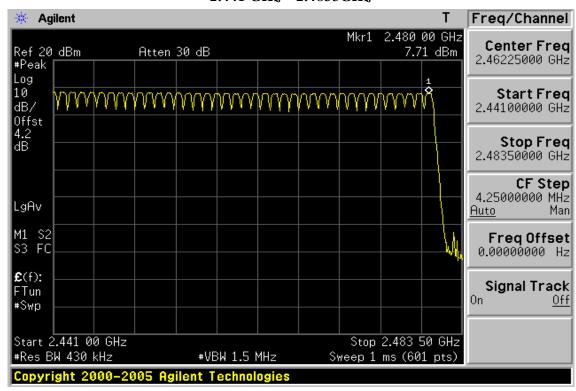
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Channel Number

2.4 GHz - 2.441GHz



2.441 GHz - 2.4835GHz



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Tabular Data of Total Channel Number:

	Channel Number	Limit
2.4 GHz – 2.441GHz	40	
2.441 GHz – 2.4835GHz	39	15
2.4GHz ~2.4835GHz	(40+39) = 79	

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13. TIME OF OCCUPANCY (DWELL TIME)

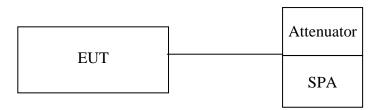
13.1. Standard Applicable

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

13.2. Measurement Equipment Used:

	Conducted Emission Test Site							
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.			
ТҮРЕ		NUMBER	NUMBER	CAL.				
Spectrum Analyzer	Agilent	E4446A	MY51100003	04/15/2011	04/14/2014			
Spectrum Analyzer	Agilent	E4440A	MY45304525	03/17/2012	03/14/2014			
DC Block	Mini-Circuits	BLK-18-S+	1	02/28/2012	02/27/2014			
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA	N/A	01/05/2012	01/04/2014			
Attenuator	Mini-Circuit	BW-S10W2+	002	02/28/2012	02/27/2014			

13.3. Test Set-up:



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13.4. Measurement Procedure:

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- 3. Set center frequency of spectrum analyzer = operating frequency.
- 4. Set the spectrum analyzer as RBW, VBW=1MHz, 3MHz, Span = 0Hz, Detector = Peak, Adjust Sweep = 2~7ms.
- 5. Repeat above procedures until all frequency of the interest measured were complete.

Formula Deduced: time occupancy of one time slot X Hopping rate / total slot in one channel / total channel that hops X period of working channels.

Where, standard hopping rate is 1600 hops/s, slot in one channel for DH1, DH3, and DH5 is 2, 4, and 6, respectively.

DH1 consists of single time slot of the uplink, and one slot of the downlink Total Slot: 2

DH3 consists of three time slot of the uplink, and one slot of the downlink. Total Slot: 4

DH5 consists of five time slot of the uplink, and one slot of the downlink. Total Slot: 6

Note: the result of the complete test default channel at 1Mbps is recorded on the test report, 2Mbps, and 3Mbps only records the measurement result at middle channel that reveals no much deviation.

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13.5. Tabular Result of the Measurement:

1Mbps (GFSK):

Test Channel:	Mode:	Measurement Result (ms):	Limit (ms):
Low:	DH1	121.60	400ms
	DH3	262.72	400ms
	DH5	307.52	400ms
Middle:	DH1	121.60	400ms
	DH3	262.72	400ms
	DH5	307.52	400ms
High:	DH1	121.60	400ms
	DH3	262.72	400ms
	DH5	307.52	400ms

2Mbps (/4 DOPSK):

Test Channel:	Mode:	Measurement Result (ms):	Limit (ms):	
Middle:	2DH1	123.84	400ms	
	2DH3	262.72	400ms	
	2DH5	307.52	400ms	

3Mbps (8DPSK):

1					
	Test Channel:	Mode:	Measurement Result	Limit (ms):	
			(ms):		
	Middle:	3DH1	123.84	400	
		3DH3	262.72	400	
		3DH5	307.52	400	

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A period time = 0.4 (s) * 79 = 31.6 (s)

1Mbps:

CH Low DH1 time slot =
$$0.380 \text{ (ms)} * (1600/2/79) * 31.6 = 121.60 \text{ (ms)}$$

DH3 time slot =
$$1.642 \text{ (ms)} * (1600/4/79) * 31.6 = 262.72 \text{ (ms)}$$

DH5 time slot =
$$2.883 \text{ (ms)} * (1600/6/79) * 31.6 = 307.52 \text{ (ms)}$$

CH Mid DH1 time slot =
$$0.380 \text{ (ms)} * (1600/2/79) * 31.6 = 121.60 \text{ (ms)}$$

DH3 time slot =
$$1.642 \text{ (ms)} * (1600/4/79) * 31.6 = 262.72 \text{ (ms)}$$

DH5 time slot =
$$2.883 \text{ (ms)} * (1600/6/79) * 31.6 = 307.52 \text{ (ms)}$$

CH High DH1 time slot =
$$0.380 \text{ (ms)} * (1600/2/79) * 31.6 = 121.60 \text{ (ms)}$$

DH3 time slot =
$$1.642 \text{ (ms)} * (1600/4/79) * 31.6 = 262.72 \text{ (ms)}$$

DH5 time slot =
$$2.883 \text{ (ms)} * (1600/6/79) * 31.6 = 307.52 \text{ (ms)}$$

2Mbps:

CH Mid 2DH1 time slot =
$$0.387 \text{ (ms)} * (1600/2/79) * 31.6 = 123.84 \text{ (ms)}$$

2DH3 time slot =
$$1.642 \text{ (ms)} * (1600/4/79) * 31.6 = 262.72 \text{ (ms)}$$

2DH5 time slot =
$$2.883 \text{ (ms)} * (1600/6/79) * 31.6 = 307.52 \text{ (ms)}$$

3Mbps:

CH Mid 3DH1 time slot =
$$0.387 \text{ (ms)} * (1600/2/79) * 31.6 = 123.84 \text{ (ms)}$$

3DH3 time slot =
$$1.642 \text{ (ms)} * (1600/4/79) * 31.6 = 262.72 \text{ (ms)}$$

3DH5 time slot =
$$2.883 \text{ (ms)} * (1600/6/79) * 31.6 = 307.52 \text{ (ms)}$$

13.6. Measurement Result:

Note: Refer to next page for plots.

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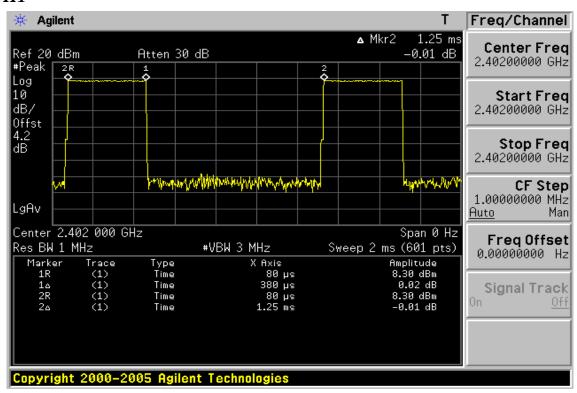
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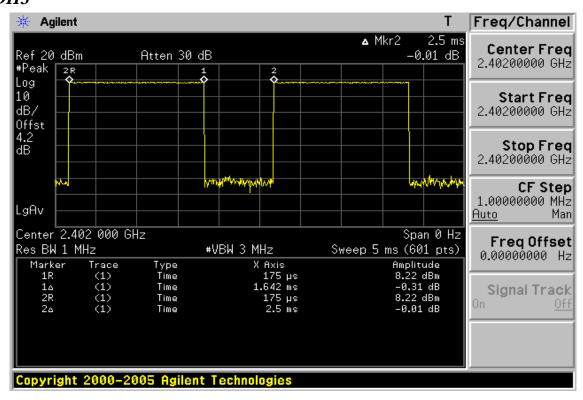
Report No.: EH/2013/40021 Issue Date: Jun. 06, 2013

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CH-Low DH1



DH3



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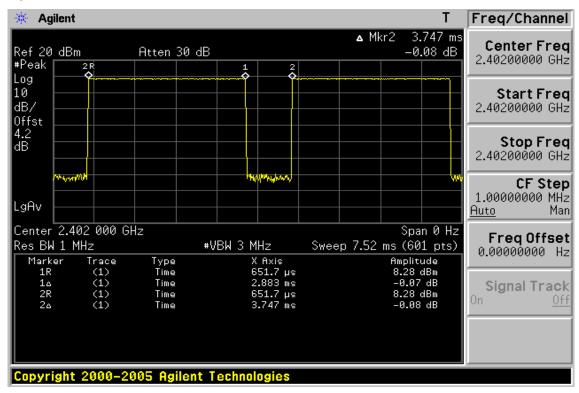
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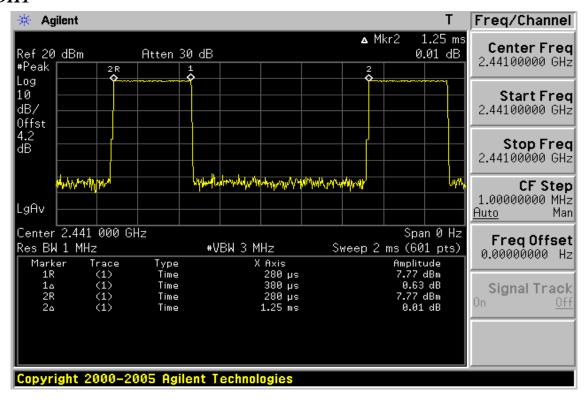
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DH₅



CH-Mid

DH1



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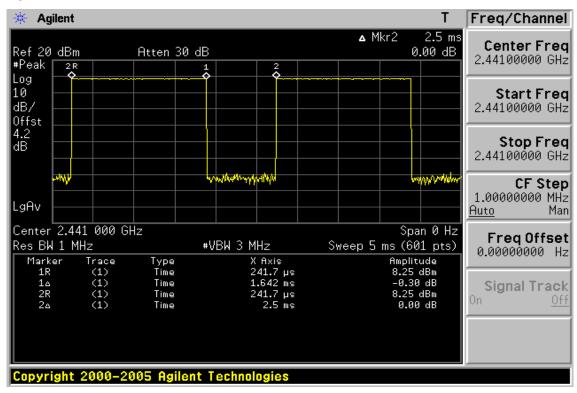
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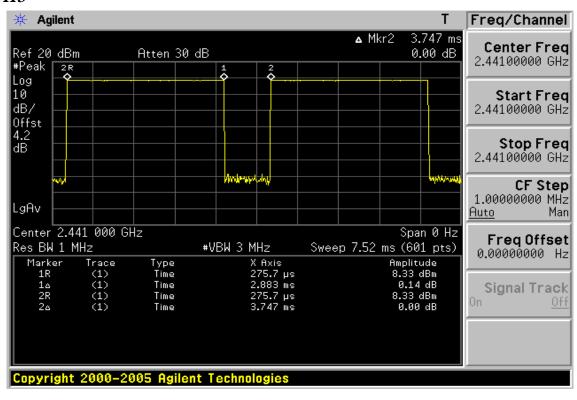
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DH3



DH5



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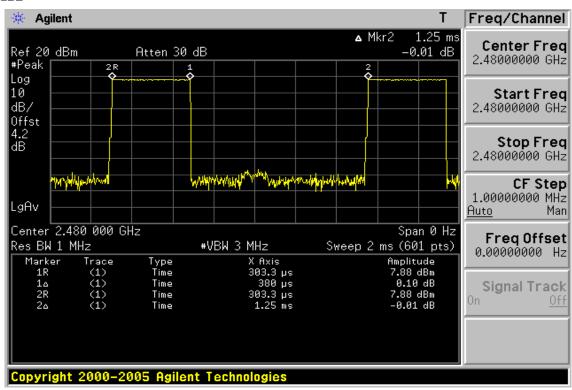
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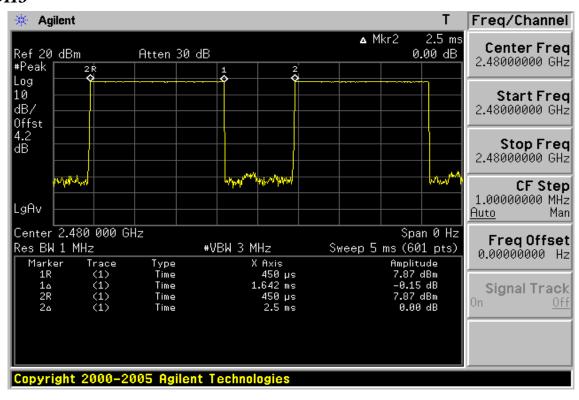
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CH-High DH1



DH3



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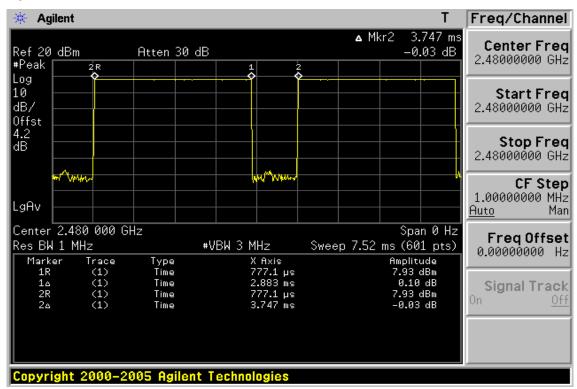
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DH5



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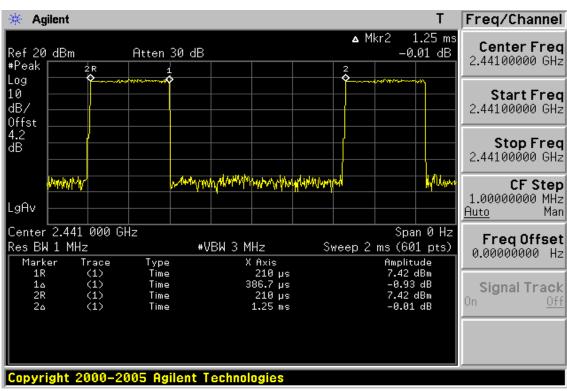
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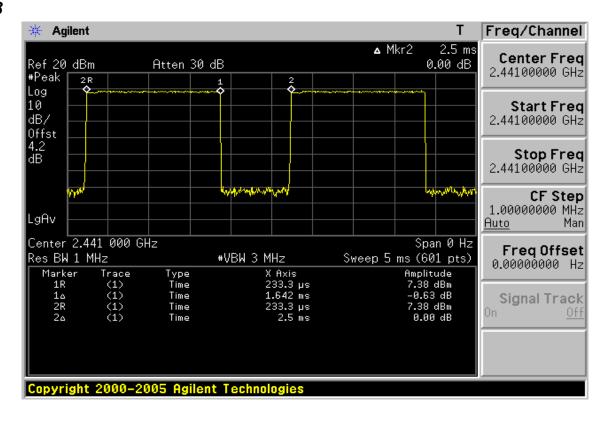
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CH-Mid 2DH1



2DH3



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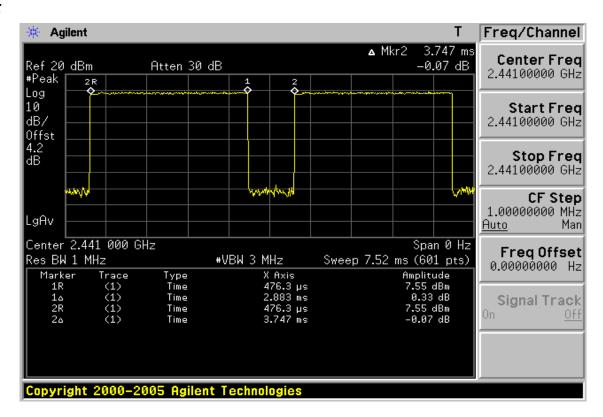
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2DH5



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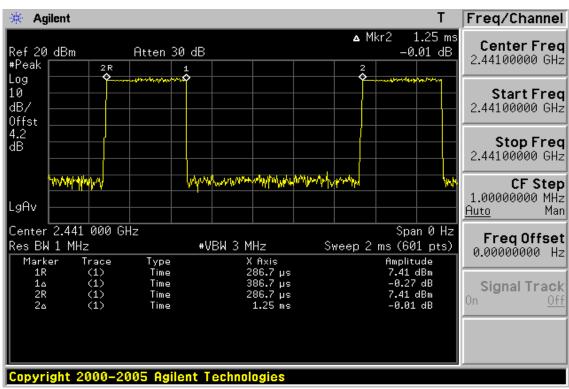
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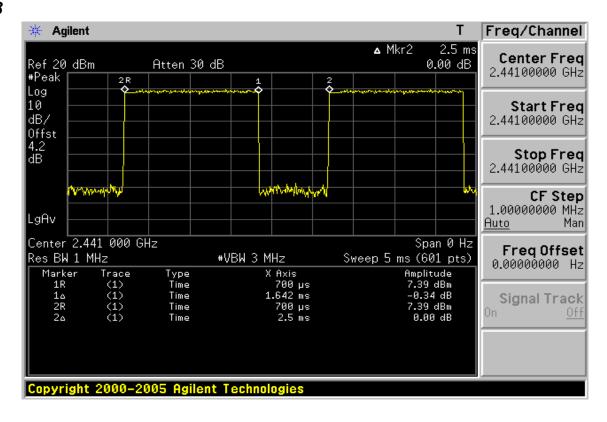
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CH-Mid 3DH1



3DH3



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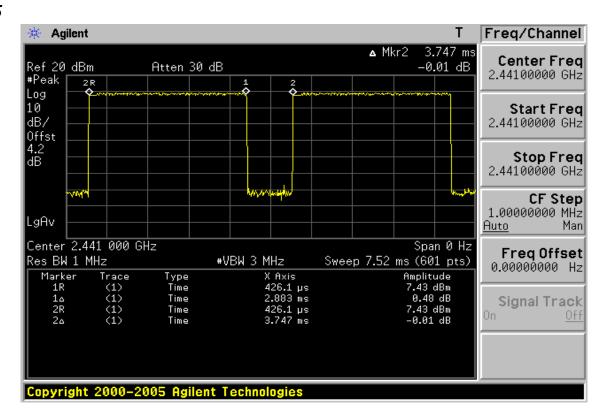
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3DH5



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14. ANTENNA REQUIREMENT

14.1. Standard Applicable

For intentional device, according to §15.203, an intentional radiator shall be designed to ensure that no antenna other than furnished by the responsible party shall be used with the device.

14.2. Antenna Connected Construction

The directional gains of antenna used for transmitting is 2.55dBi, and the antenna connector is designed with unique type RF connector and no consideration of replacement. Please see EUT photo and antenna spec. for details.

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APPENDIX 1 MEASUREMENT PLOT OF RADIATED SPURIOUS **EMISSION**

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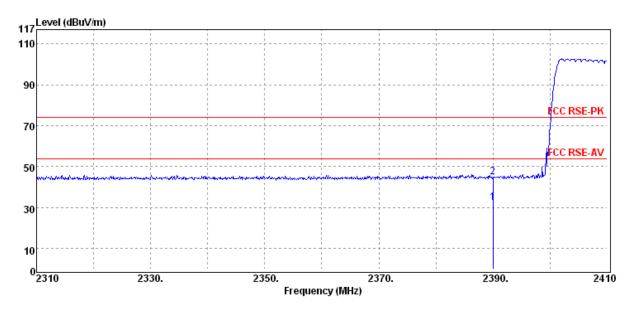
Band Edges Radiated Emission:

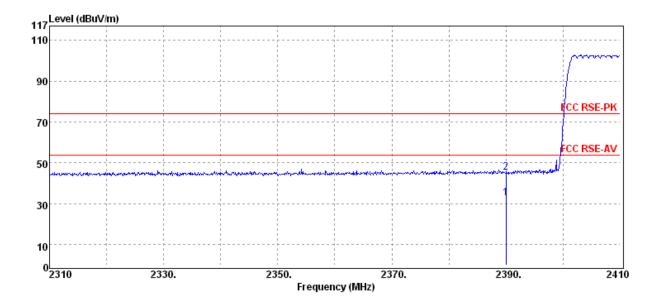
Note: The emission that surpasses the limit of peak represents the fundamental emission of the operation that does not account to be conformed to the limit of the interest.

Note: The trace on RE (radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

Operation Band :EDR Test Date :2013-04-24 Fundamental Frequency :2402 MHz Temp./Humi. :23deg_C/52RH

Operation Mode :Bandedge LOW Engineer :Louis EUT Pol. :E2 Plan Measurement Antenna Pol. :Ver. / Hor.





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Operation Band **Fundamental Frequency** Operation Mode EUT Pol.

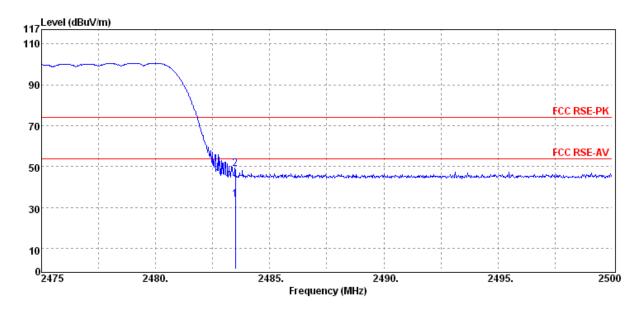
:EDR :2480 MHz :Bandedge HIGH

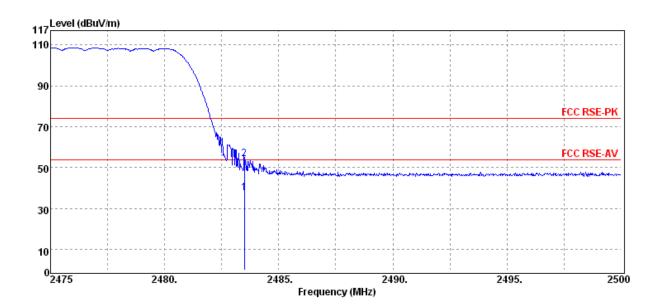
:E2 Plan

Test Date Temp./Humi. Engineer

:2013-04-24 :23deg_C/52RH

:Louis Measurement Antenna Pol. :Ver. / Hor.





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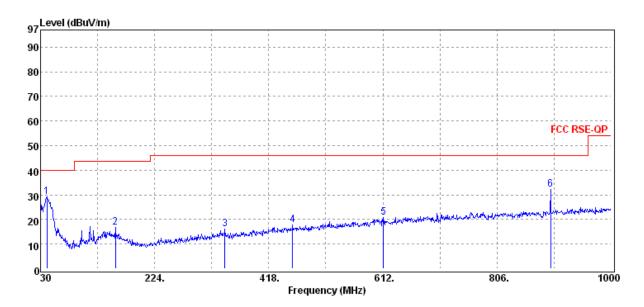
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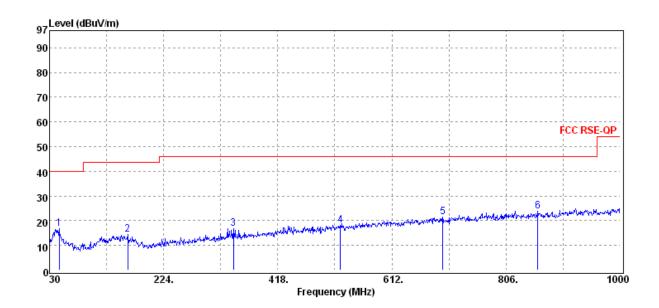
Radiated Spurious Emission Measurement photos Result (below 1GHz)

Note: The trace on RE (radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

Operation Band :EDR Test Date :2013-04-03 Fundamental Frequency :2402 MHz Temp./Humi. :23deg_C/52RH

Operation Mode :TX LOW Engineer :Louis EUT Pol. :E2 Plan Measurement Antenna Pol. :Ver. / Hor.





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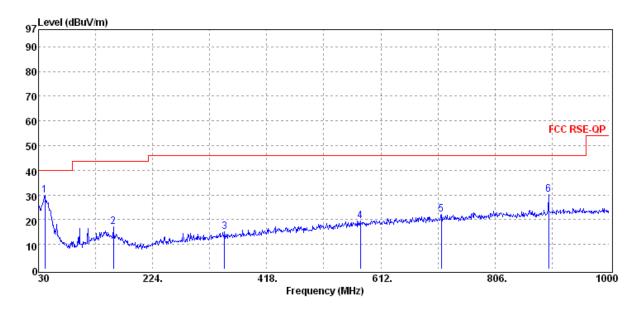


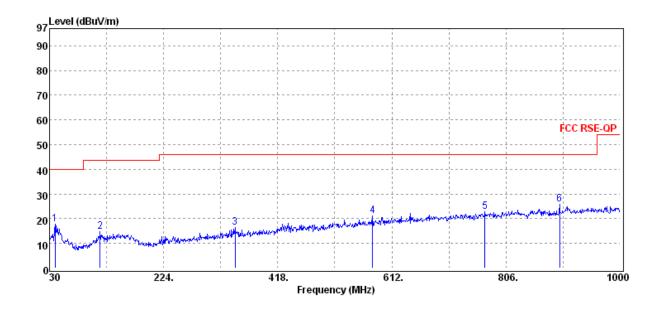
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Operation Band :EDR Test Date :2013-04-03 Fundamental Frequency :2441 MHz Temp./Humi. :23deg_C/52RH

Operation Mode :TX MID Engineer :Louis EUT Pol. : E2 Plan Measurement Antenna Pol. : Ver. / Hor.





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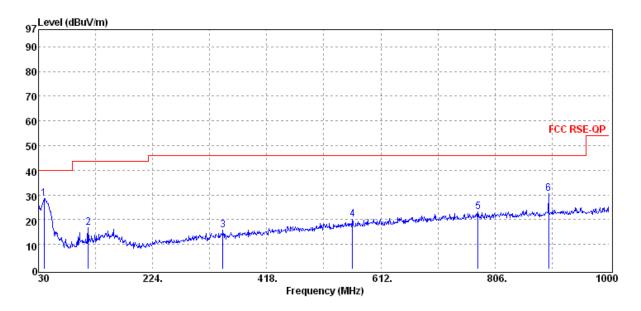


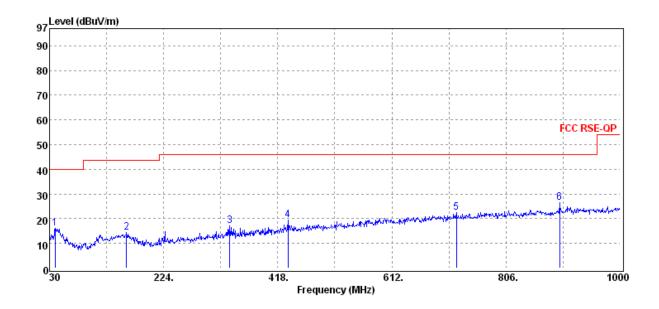
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Operation Band :EDR Test Date :2013-04-03 Fundamental Frequency: 2480 MHz Temp./Humi. :23deg_C/52RH

Operation Mode :TX HIGH Engineer :Louis EUT Pol. : E2 Plan Measurement Antenna Pol. : Ver. / Hor.





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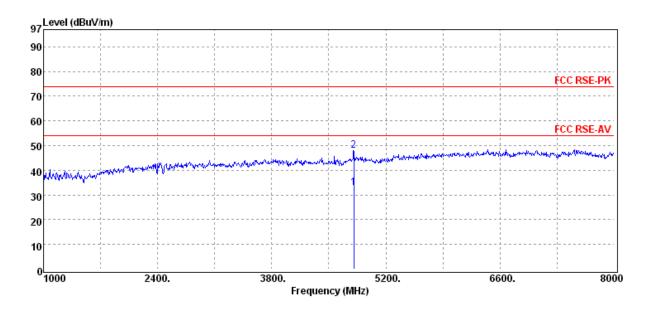
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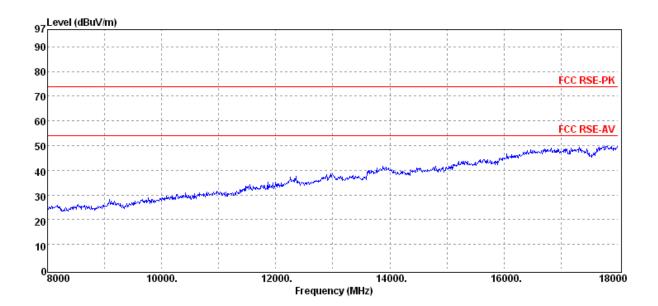
Radiated Spurious Emission Measurement photos Result (above 1GHz)

Operation Band :EDR Test Date :2013-04-03 Fundamental Frequency :2402 MHz Temp./Humi. :23deg_C/52RH

Operation Mode :TX LOW Engineer :Louis

EUT Pol. : E2 Plan Measurement Antenna Pol. : VERTICAL





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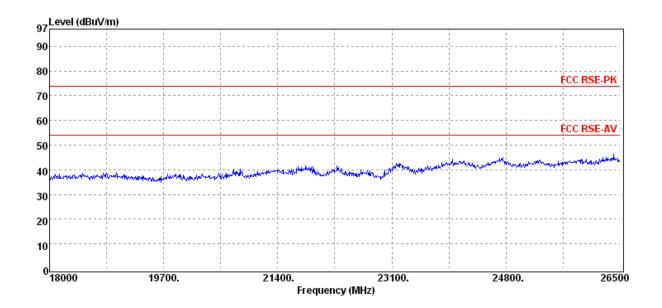
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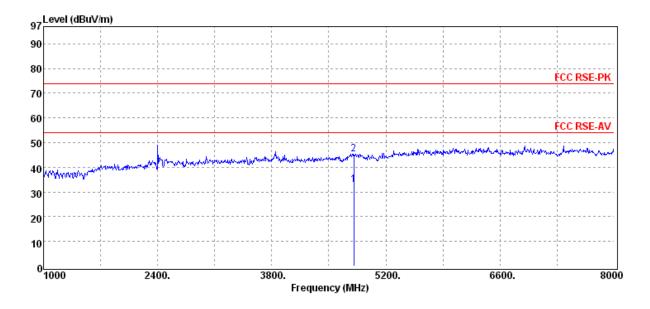
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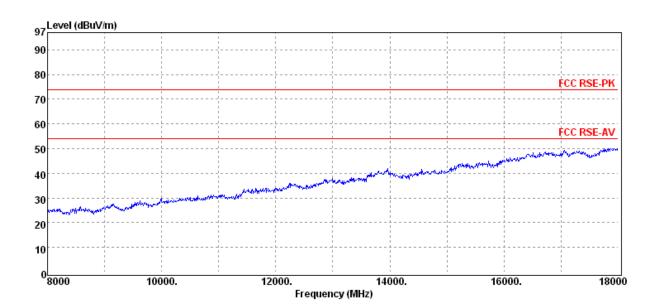
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Operation Band :EDR Test Date :2013-04-03 :23deg_C/52RH Fundamental Frequency :2402 MHz Temp./Humi.

Operation Mode :TX LOW Engineer :Louis

EUT Pol. :E2 Plan Measurement Antenna Pol. :HORIZONTAL





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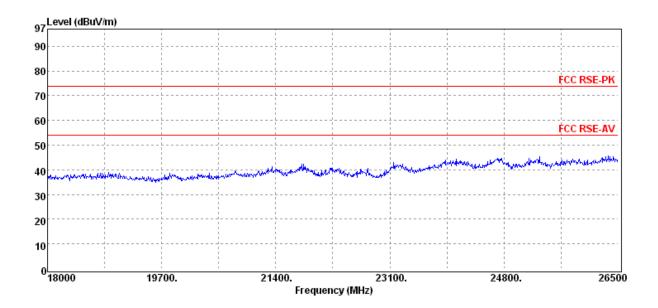
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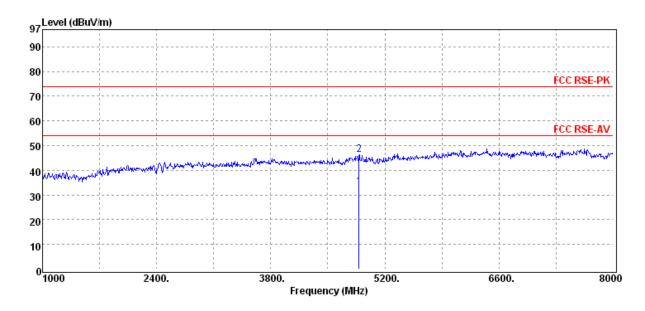
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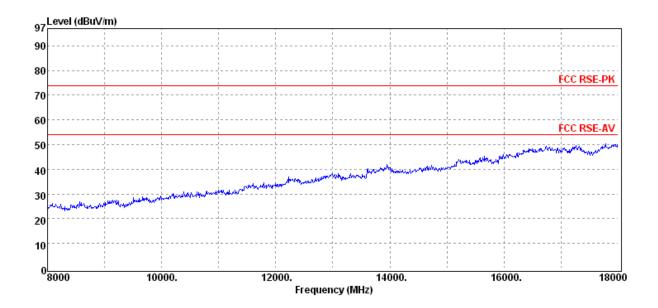
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Operation Band :EDR Test Date :2013-04-03 Fundamental Frequency: 2441 MHz Temp./Humi. :23deg_C/52RH

Operation Mode :TX MID Engineer :Louis

EUT Pol. :E2 Plan Measurement Antenna Pol. : VERTICAL





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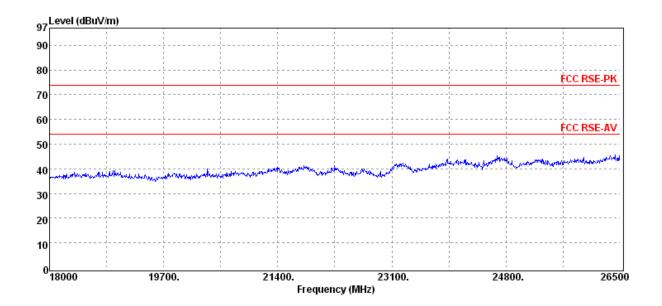
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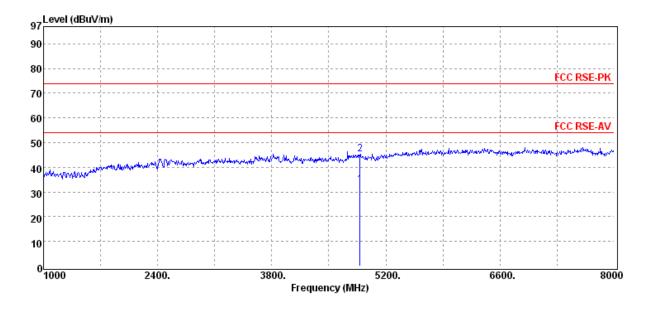
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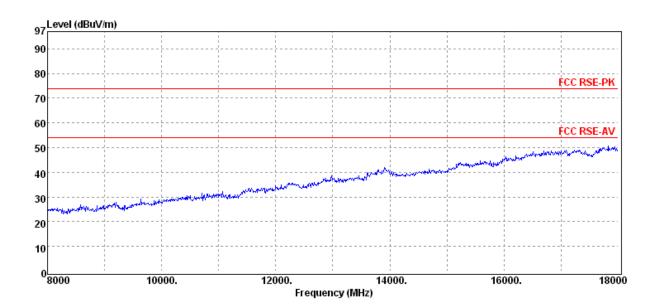
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Operation Band :EDR Test Date :2013-04-03 :23deg_C/52RH Fundamental Frequency: 2441 MHz Temp./Humi.

Operation Mode :TX MID Engineer :Louis

EUT Pol. :E2 Plan Measurement Antenna Pol. :HORIZONTAL





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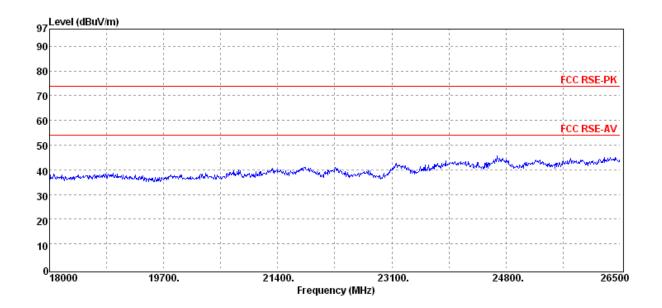
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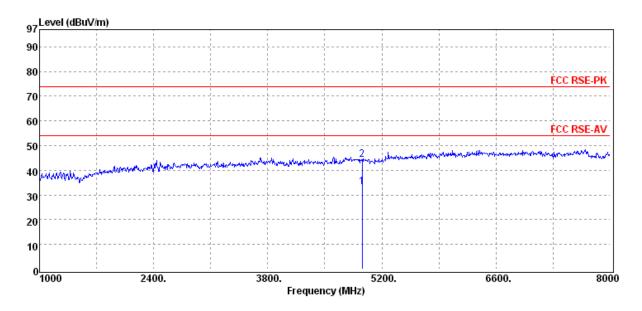
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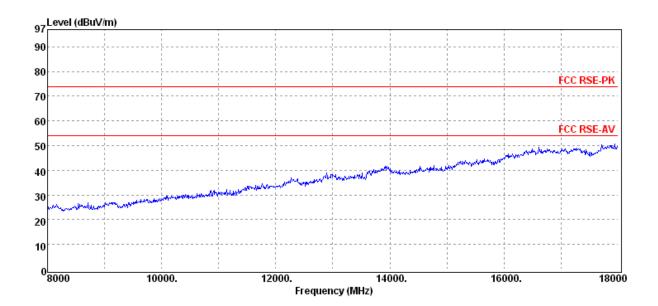
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Operation Band :EDR Test Date :2013-04-03 Fundamental Frequency: 2480 MHz Temp./Humi. :23deg_C/52RH

Operation Mode :TX HIGH Engineer :Louis

EUT Pol. :E2 Plan Measurement Antenna Pol. : VERTICAL





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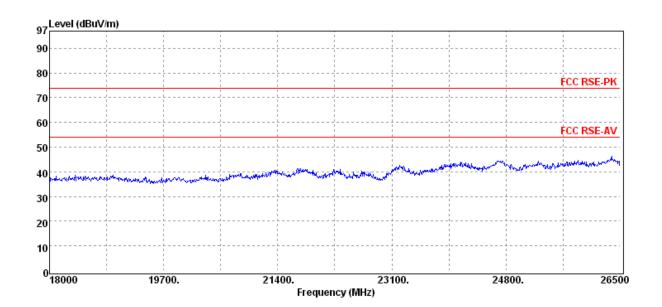
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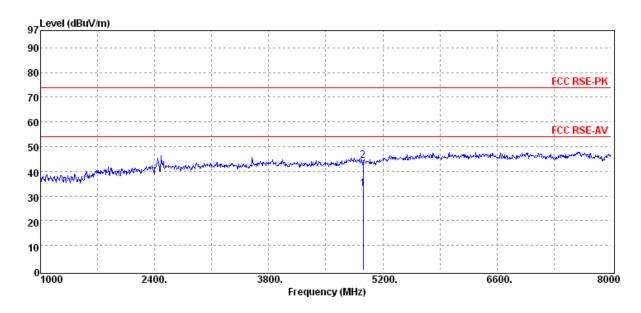
Report No.: EH/2013/40021 Issue Date: Jun. 06, 2013

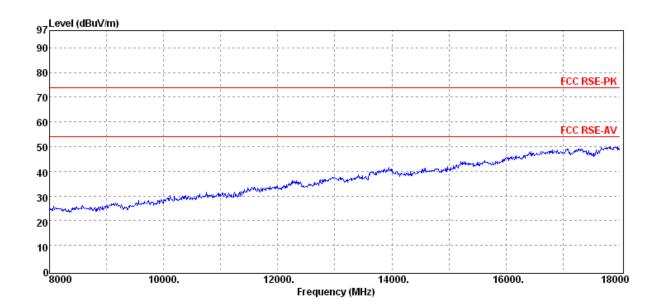
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Operation Band :EDR Test Date :2013-04-03 :23deg_C/52RH Fundamental Frequency: 2480 MHz Temp./Humi.

Operation Mode :TX HIGH Engineer :Louis

EUT Pol. :E2 Plan Measurement Antenna Pol. :HORIZONTAL





Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

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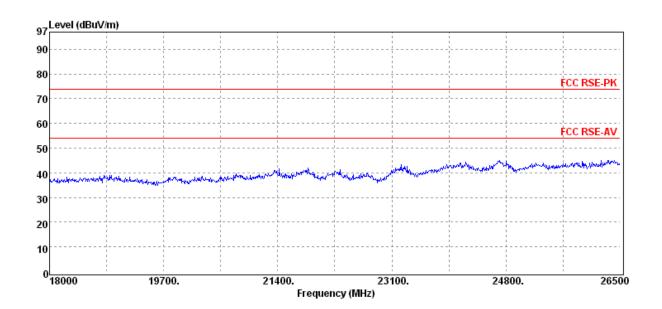
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~ End of Report ~

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