

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT

OF

Product Name: Bluetooth V3.0 Mono Headset

Brand Name: PCI

Model No.: BT-07HS

Model Difference: N/A

FCC ID: SJ9BT-07HS

Report No.: ER/2011/30013-03

Issue Date: Jun. 06, 2012

FCC Rule Part: §15.247, Cat: DSS

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VERIFICATION OF COMPLIANCE

Applicant: PLANEX COMMUNICATIONS INC.
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150-0011, Japan

Equipment Under Test: Bluetooth V3.0 Mono Headset

Brand Name: PCI

Model No.: BT-07HS

Model Difference: N/A

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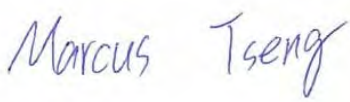
Date of test: Apr. 16, 2012 ~ Jun. 05, 2012

Date of EUT Received: Apr. 16, 2012

We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4:2003 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.

Test By:		Date:	Jun. 06, 2012
	Marcus Tseng / Engineer		
Prepared By:		Date:	Jun. 06, 2012
	Cherry Chen / Clerk.		
Approved By:		Date:	Jun. 06, 2012
	Jim Chang / Supervisor		

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Version

Version No.	Date	Description
00	Jun. 06, 2012	Initial creation of document

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Table of Contents

1. GENERAL INFORMATION	7
1.1. Related Submittal(s) / Grant (s)	8
1.2. Test Methodology	8
1.3. Test Facility	8
1.4. Special Accessories	8
1.5. Equipment Modifications	8
2. SYSTEM TEST CONFIGURATION	9
2.1. EUT Configuration	9
2.2. EUT Exercise	9
2.3. Test Procedure	9
2.4. Configuration of Tested System	10
3. SUMMARY OF TEST RESULTS	11
4. DESCRIPTION OF TEST MODES	11
5. MEASUREMENT UNCERTAINTY FOR FIELD STRENGTH OF SPURIOUS RADIATION	12
6. CONDUCTED EMISSION TEST	13
6.1. Standard Applicable	13
6.2. EUT Setup	13
6.3. Measurement Procedure	13
6.4. Measurement Equipment Used:	14
6.5. Measurement Result	14
7. PEAK OUTPUT POWER MEASUREMENT	17
7.1. Standard Applicable	17
7.2. Measurement Equipment Used	17
7.3. Test Set-up:	17
7.4. Measurement Procedure:	17
7.5. Measurement Result	18
8. 20dB BAND WIDTH	22
8.1. Standard Applicable	22
8.2. Measurement Equipment Used	22
8.3. Test Set-up	22
8.4. Measurement Procedure:	22
8.5. Measurement Result:	23

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9.	100KHz BANDWIDTH OF BAND EDGES MEASUREMENT.....	28
9.1.	Standard Applicable	28
9.2.	Measurement Equipment Used	28
9.3.	Test SET-UP:.....	29
9.4.	Measurement Procedure.....	30
9.5.	Field Strength Calculation	30
9.6.	Measurement Result.....	30
10.	SPURIOUS RADIATED EMISSION TEST.....	35
10.1.	Standard Applicable	35
10.2.	Measurement Equipment Used:.....	35
10.3.	Test SET-UP:.....	35
10.4.	Measurement Procedure:	35
10.5.	Field Strength Calculation	36
10.6.	Measurement Result:	36
11.	FREQUENCY SEPARATION	46
11.1.	Standard Applicable	46
11.2.	Measurement Equipment Used:.....	46
11.3.	Test Set-up:	46
11.4.	Measurement Procedure:	46
11.5.	Measurement Result:	46
12.	NUMBER OF HOPPING FREQUENCY	48
12.1.	Standard Applicable	48
12.2.	Measurement Equipment Used:.....	48
12.3.	Test Set-up:	48
12.4.	Measurement Procedure:	48
12.5.	Measurement Result:	48
13.	TIME OF OCCUPANCY (DWELL TIME)	50
13.1.	Standard Applicable	50
13.2.	Measurement Equipment Used:.....	50
13.3.	Test Set-up:	50
13.4.	Measurement Procedure:	50
13.5.	Measurement Result.....	51

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14. ANTENNA REQUIREMENT	57
14.1. Standard Applicable	57
14.2. Antenna Connected Construction	57

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1. GENERAL INFORMATION

General:

Product Name	Bluetooth V3.0 Mono Headset	
Brand Name	PCI	
Model No.	BT-07HS	
Model Difference	N/A	
Hardware Version	VEN-048	
Power Supply	3.7V from Battery and USB 5V charge function	
	Battery:	Model: GSP051221, Supplier: Great Power

Bluetooth:

Bluetooth Version:	☐ V1.1 (GFSK) ☐ V1.2 (GFSK) ☐ V2.0 (GFSK) ☐ V2.0 + EDR (GFSK + $\pi/4$ DQPSK + 8DPSK) ☐ V2.1 + EDR (GFSK + $\pi/4$ DQPSK + 8DPSK) ☒ V3.0 + EDR
Channel number:	79 channels
Modulation type:	GFSK + $\pi/4$ DQPSK + 8DPSK
Output Power:	5.69 dBm (Max. BDR mode)
Frequency Range:	2.402GHz – 2.480GHz
Dwell Time:	$\leq 0.4s$
Operating Mode:	Point-to-Point
Antenna Designation:	Chip Antenna with 2dBi peak gain

The EUT is compliance with Bluetooth 3.0 + EDR Standard.

This report applies for Bluetooth, and complies with FCC rule part 15C.

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

This submittal(s) (test report) is intended for **FCC ID: SJ9BT-07HS** filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules. The composite system (digital device) is compliance with Subpart B is authorized under a Doc procedure.

1.2. Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4: 2003. Radiated testing was performed at an antenna to EUT distance 3 meters.

Tested in accordance with FCC Public Notice DA 00-705

1.3. 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 Rd., Wuku Industrial Zone, Taipei Country, Taiwan which are constructed and calibrated to meet the FCC requirements in documents ANSI C63.4: 2003. FCC Registration Number are: 990257 and 236194, 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.

1.4. Special Accessories

Not available for this EUT intended for grant.

1.5. Equipment Modifications

Not available for this EUT intended for grant.

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2. 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

The EUT (Transmitter) was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements.

2.3. Test Procedure

2.3.1 Conducted Emissions

The EUT is placed on a turn table which is 0.8 m above ground plane. According to the requirements in Section 7 and 13 of ANSI C63.4: 2003, conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz using CISPR Quasi-Peak and Average detector mode.

2.3.2 Radiated Emissions

The EUT is placed on a 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 Subclause 8.3.1.2 of ANSI C63.4: 2003.

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2.4. Configuration of Tested System

Fig. 2-1 Radiated Emission Configuration

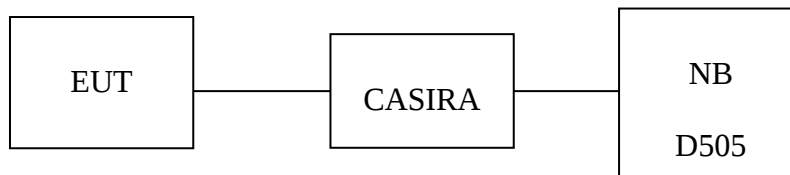


Fig. 2-2 AC Power line Emission Configuration

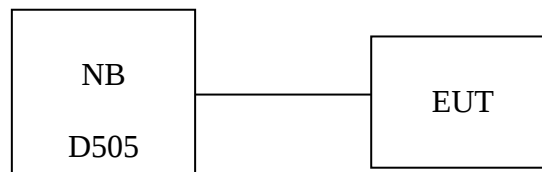


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/ Type No.	Series No.	Data Cable	Power Cord
1	Software	BlueSuite 1.22	CSR	Version1.22	N/A	Un-shielded
2	CASIRA	CSR	BCES301199/1	7383070403	N/A	Un-shielded
3	Notebook	DELL	D504	CNF345Q1R	N/A	Un-shielded

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3. SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§15.207(a)	Conducted Emission	Compliant
§15.247(b)(1)	Peak Output Power	Compliant
§15.247(a)	20dB Bandwidth	Compliant
§15.247I	100 KHz Bandwidth Of Frequency Band Edges	Compliant
§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, §15.247(b)(4)(i)	Antenna Requirement	Compliant

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 mode is programmed.

Channel Low, Mid and High with Highest rated data rate were chosen as worst case for full testing.

In comparison with BDR and EDR mode, emission carried out by BDR is chosen as the most representative measurement to perform measurement of every test item pursuant to Part 15C.

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5. MEASUREMENT UNCERTAINTY FOR FIELD STRENGTH OF SPURIOUS RADIATION

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

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

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6. CONDUCTED EMISSION TEST

6.1. Standard Applicable

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

Frequency range MHz	Limits dB(uV)	
	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		
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.		

6.2. EUT Setup

1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.4: 2003.
2. The EUT was plug-in the AC/DC Power adapter. The host system was placed on the center of the back edge on the test table. The peripherals was placed on the side of the host PC system. The rear of the EUT and peripherals were placed flushed with the rear of the tabletop.
3. The spacing between the peripherals was 10 centimeters.
4. External I/O cables were draped along the edge of the test table and bundle when necessary.
5. The host system was connected with 120Vac/60Hz power source.

6.3. 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.

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6.4. Measurement Equipment Used:

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESCI7	100759	05/20/2011	05/19/2013
EMI Receiver	R&S	ESCS 30	828985/004	09/23/2011	09/22/2012
LISN	Rolf-Heine	NNB-2/16Z	99012	03/23/2012	03/22/2013
LISN	FCC	FCC-LISN-50/250-2 5-2-01	04034	03/23/2012	03/22/2013
Coaxial Cables	N/A	WK CE Cable	N/A	01/04/2011	01/03/2013

6.5. Measurement Result

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. Significant peaks are then marked as shown on the following data page, and these signals are then quasi-peaked.

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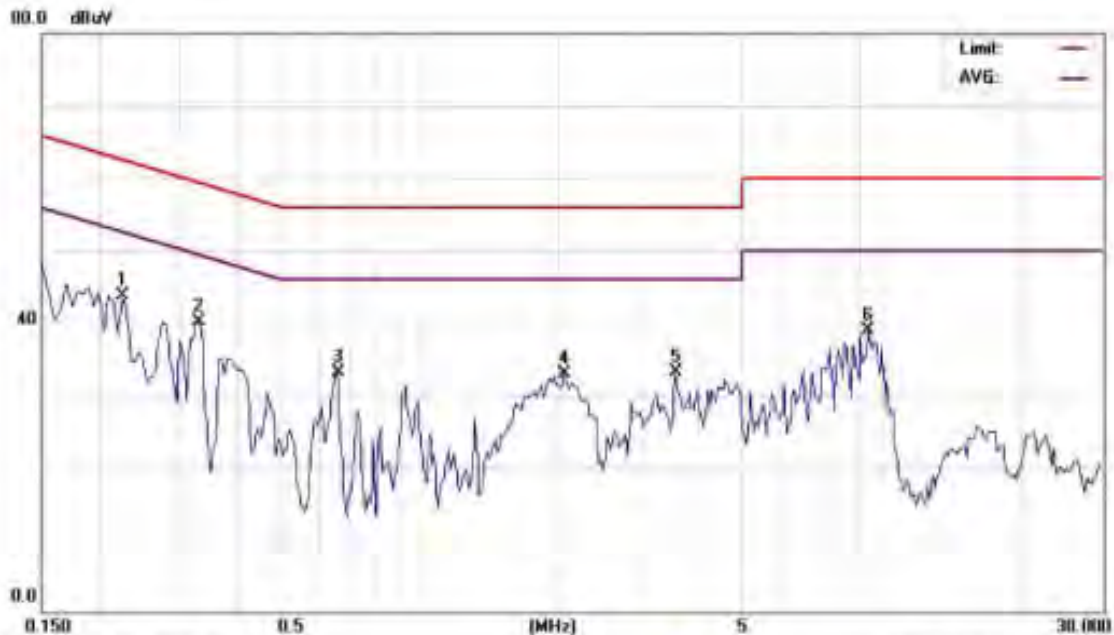
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AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	Bluetooth Mode			Test Date:	May. 15, 2012
Temperature:	23 °C	Humidity:	55 %	Test By:	Marcus



Site: SGS CONDUCTED #1

Phase: L1

Temperature: 24 °C

Limit: CISPR22/11/EN55022 Class B

Power: AC 120V/60Hz

Humidity: 60%

EUT: Bluetooth Mono Headset

Distance:

Air Pressure: hpa

M/N: BT-07HS

Note: BT Operation

No.	Mk.	Freq. MHz	Reading Level dBμV	Factor dB	Measure- ment dBμV	Limit dBμV	Over dB	Detector	Comment
1	*	0.2250	43.61	0.05	43.66	62.63	-18.97	peak	
2		0.3300	40.11	0.05	40.16	59.45	-19.29	peak	
3		0.6600	33.12	0.06	33.18	56.00	-22.82	peak	
4		2.0500	32.76	0.09	32.85	56.00	-23.15	peak	
5		3.5700	32.93	0.11	33.04	56.00	-22.96	peak	
6		9.3800	38.60	0.33	38.93	60.00	-21.07	peak	

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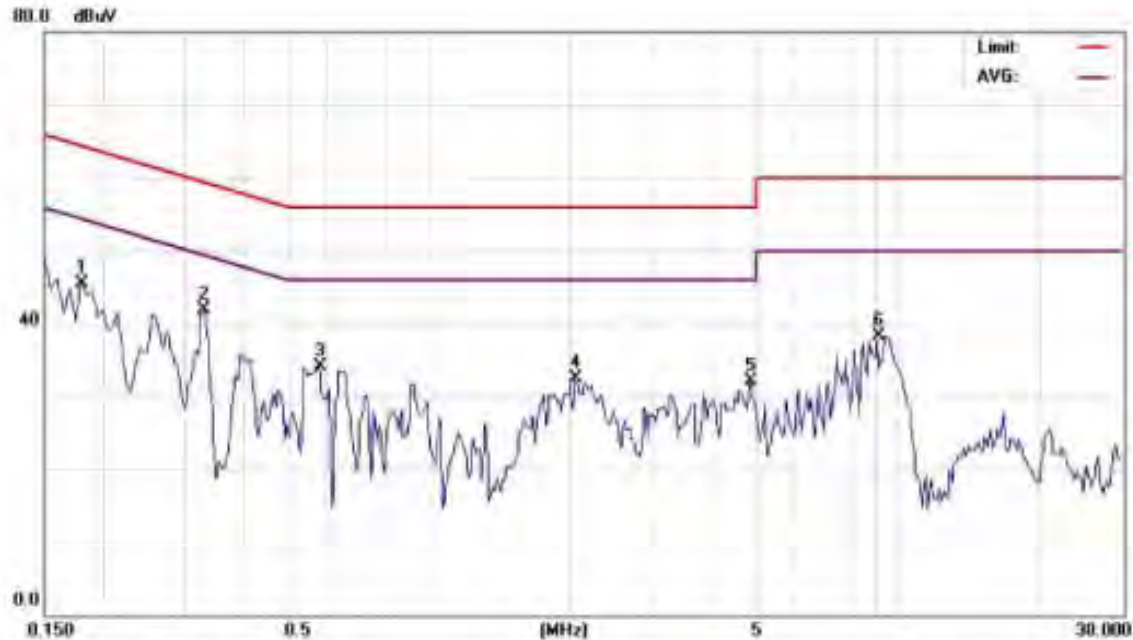
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Site: SGS CONDUCTED #1

Limit: CISPR22/11/EN55022 Class B

EUT: Bluetooth Mono Headset

MN: BT-07HS

Note: BT Operation

Phase: N

Power: AC 120V/60Hz

Distance:

Temperature: 24 °C

Humidity: 60%

Air Pressure: hpa

No.	Mk.	Freq. MHz	Reading Level dBμV	Factor dB	Measure- ment dBμV	Limit dBμV	Over dB	Detector	Comment
1		0.1800	45.51	0.05	45.56	64.49	-18.93	peak	
2	*	0.3300	41.94	0.05	41.99	59.45	-17.46	peak	
3		0.5800	34.05	0.06	34.11	56.00	-21.89	peak	
4		2.0500	32.33	0.09	32.42	56.00	-23.58	peak	
5		4.8400	31.92	0.12	32.04	56.00	-23.96	peak	
6		9.0600	38.08	0.31	38.39	60.00	-21.61	peak	

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7. PEAK OUTPUT POWER MEASUREMENT

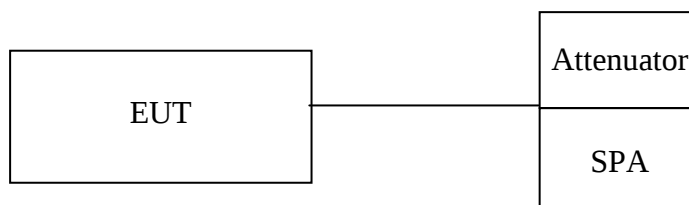
7.1. Standard Applicable

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels, and all frequency hopping systems in the 5725-5850MHz band: 1Watt. For all other frequency hopping systems in the 2400 – 2483.5MHz band: 0.125 Watts.

7.2. Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
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	04/15/2011	04/14/2013
Spectrum Analyzer	Agilent	E4440A	MY45304525	03/17/2012	03/16/2014
DC Block	Mini-Circuits	BLK-18-S+	1	02/28/2012	02/27/2013
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA	N/A	01/05/2012	01/04/2013
Attenuator	Mini-Circuit	BW-S10W2+	002	02/28/2012	02/27/2013
Splitter	Agilent	11636B	N/A	02/28/2012	02/27/2013

7.3. Test Set-up:



7.4. Measurement Procedure:

1. Place the EUT on the table and set it in transmitting mode.

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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 peak function, >20dB bandwidth, >=RBW)
3. Record the max. reading.
4. Repeat above procedures until all frequency measured were complete.

7.5. Measurement Result

BDR mode:

Frequency (MHz)	Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
2402.00	5.69	0.00	5.69	0.00371	1
2441.00	4.93	0.00	4.93	0.00311	1
2480.00	3.80	0.00	3.80	0.00240	1

EDR mode:

Frequency (MHz)	Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
2402.00	4.43	0.00	4.43	0.00277	1
2441.00	3.54	0.00	3.54	0.00226	1
2480.00	2.24	0.00	2.24	0.00167	1

NOTE: offset: 1dB

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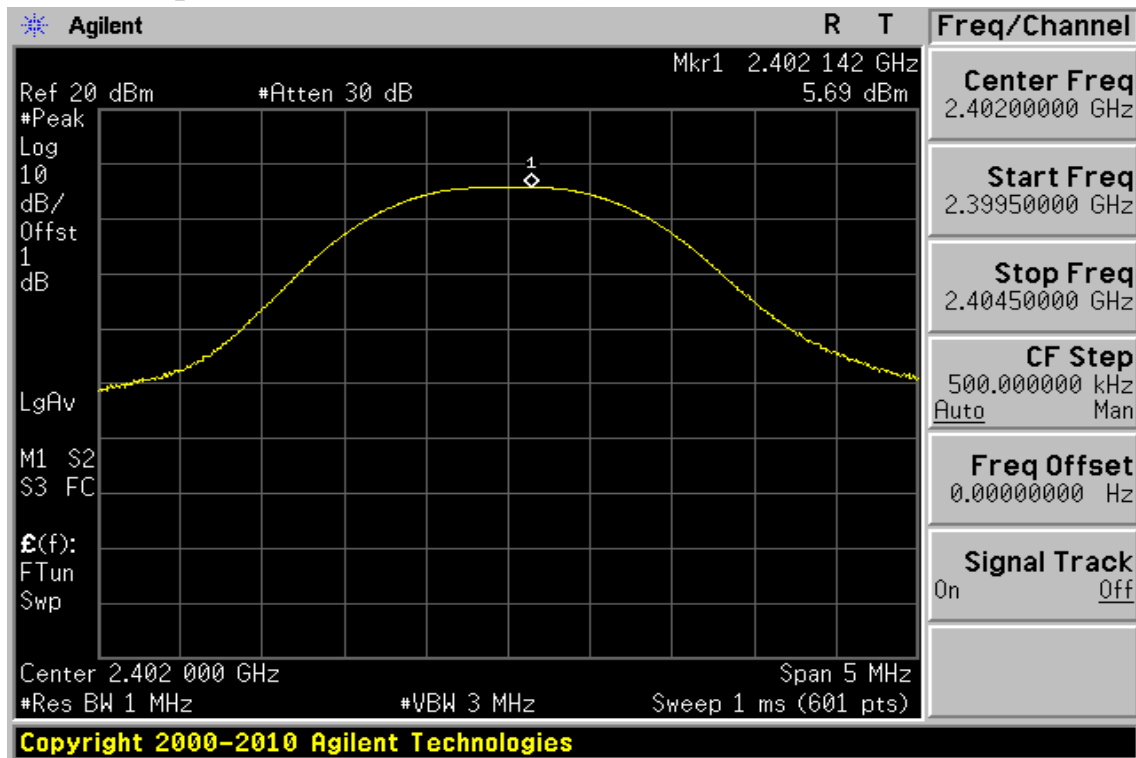
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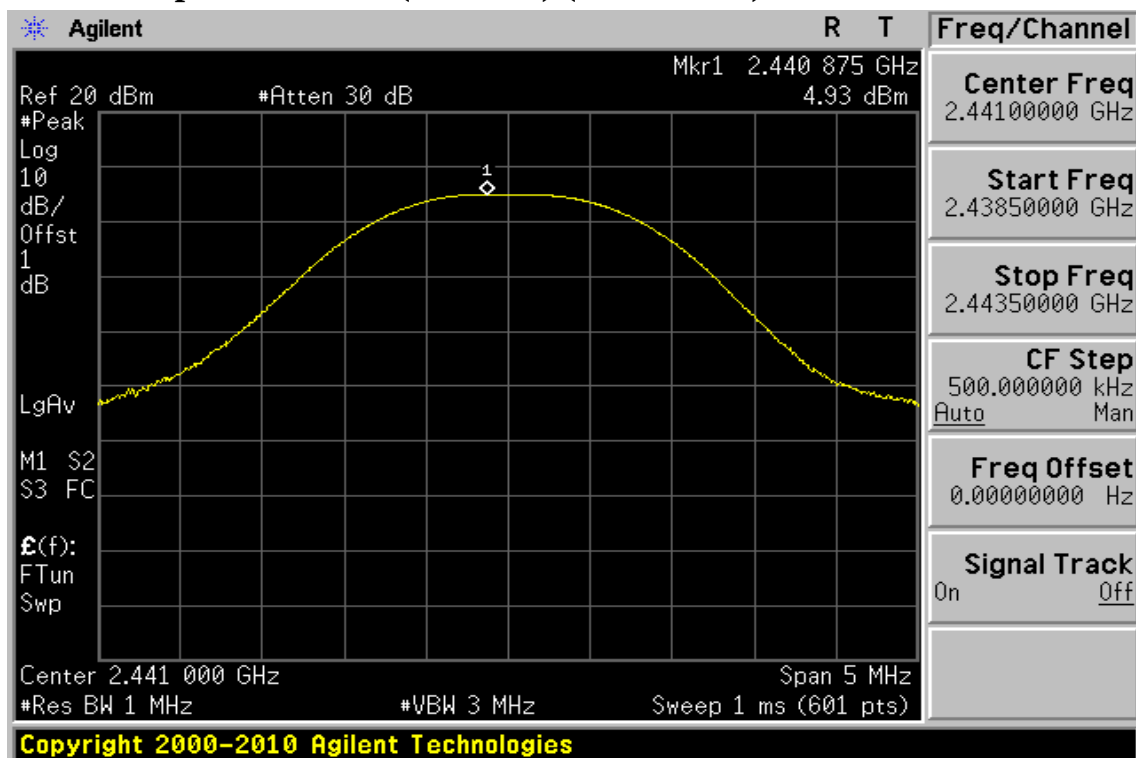
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Peak Power Output Data Plot (CH Low) (BDR mode)



Peak Power Output Data Plot (CH Mid) (BDR mode)



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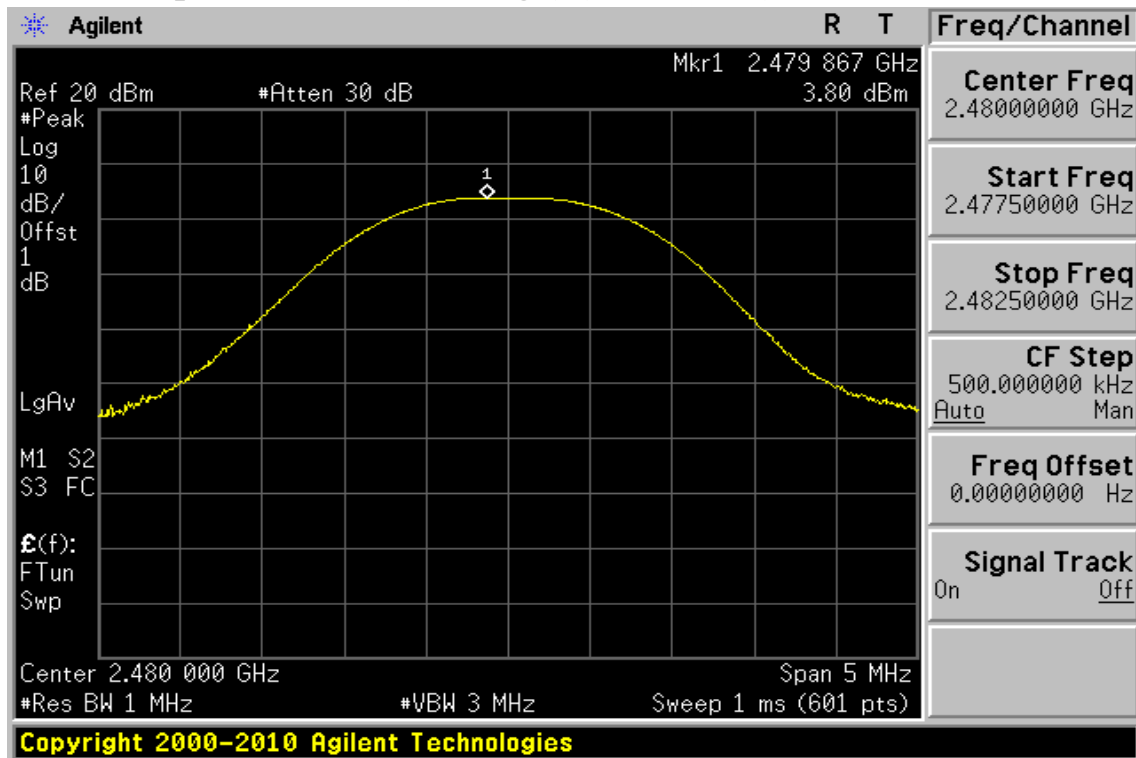
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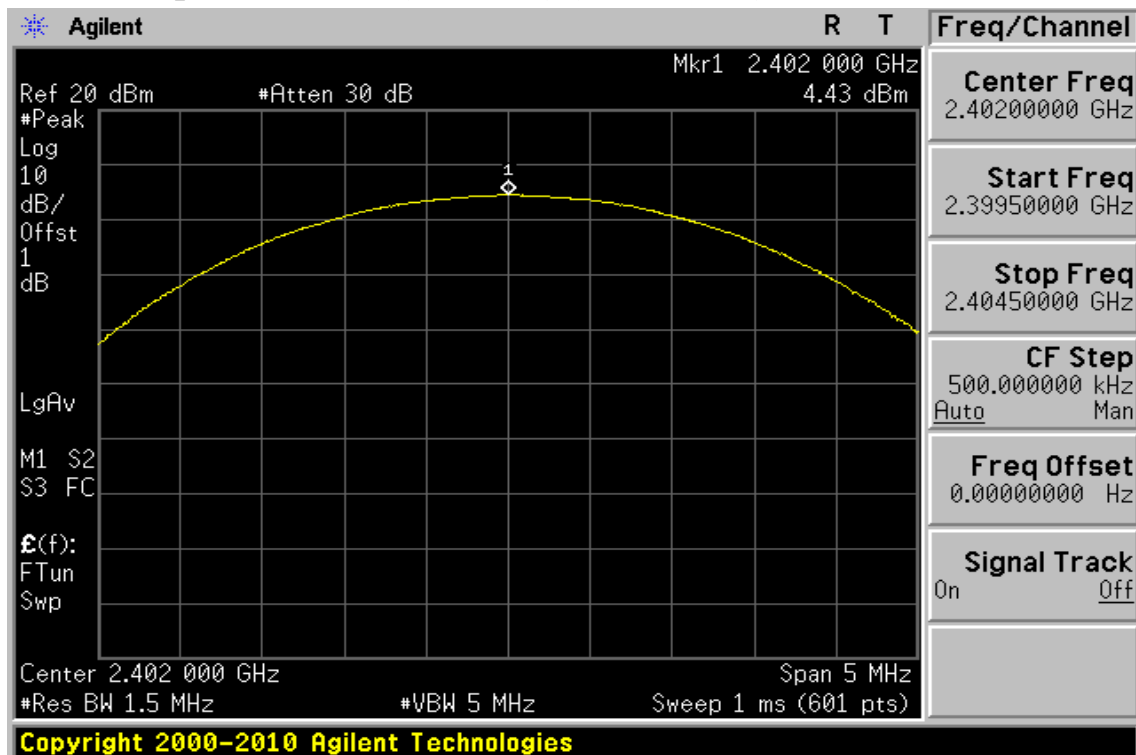
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Peak Power Output Data Plot (CH High) (BDR mode)



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



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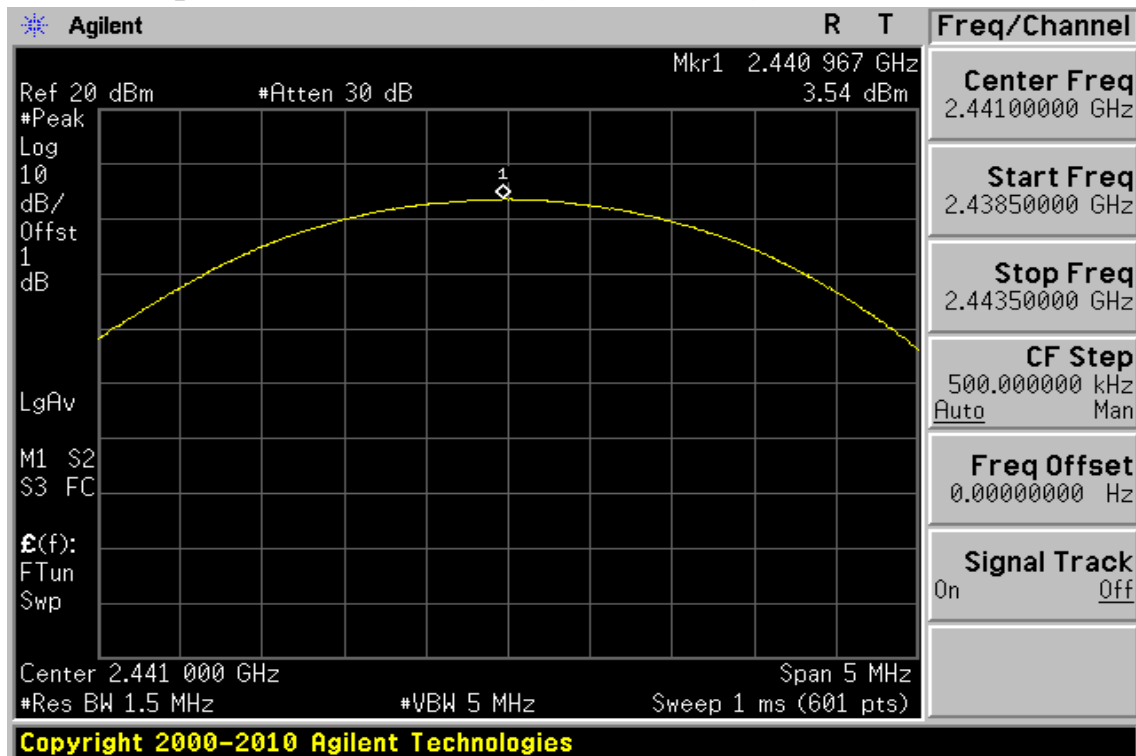
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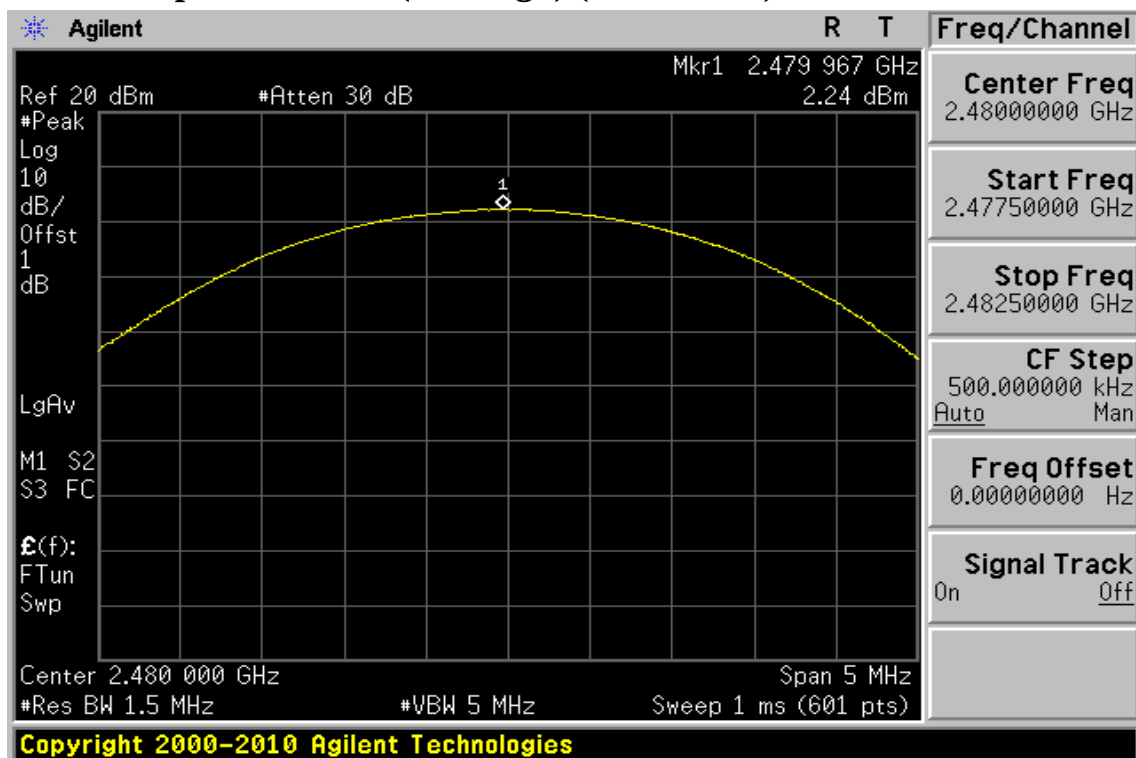
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Peak Power Output Data Plot (CH Mid) (EDR mode)



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



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8. 20dB BAND WIDTH

8.1. Standard Applicable

For frequency hopping systems operating in the 2400MHz-2483.5 MHz no limit for 20dB bandwidth.

8.2. Measurement Equipment Used

Refer to section 7.2 for details.

8.3. Test Set-up

Refer to section 7.3 for details.

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=10KHz (1 % of Bandwidth.), Span= 3MHz, Sweep=auto
4. Mark the peak frequency and -20dB (upper and lower) frequency.
5. Repeat above procedures until all frequency measured were complete.

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8.5. Measurement Result:

BDR mode:

CH	Bandwidth (kHz)
Lower	926.0000
Mid	928.0000
Higher	928.0000

EDR mode:

CH	Bandwidth (MHz)	2/3 Bandwidth (MHz)
Lower	1.2700	0.847
Mid	1.2700	0.847
Higher	1.2600	0.840

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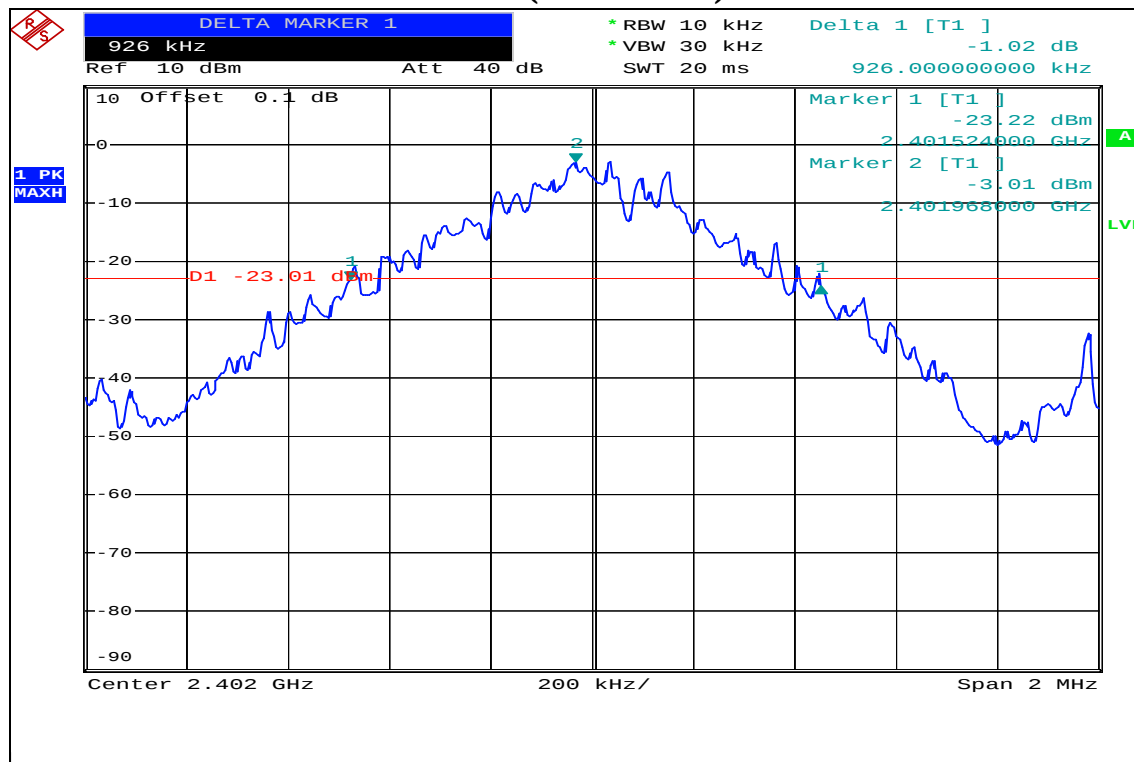
t (886-2) 2299-3279

f (886-2) 2298-0488

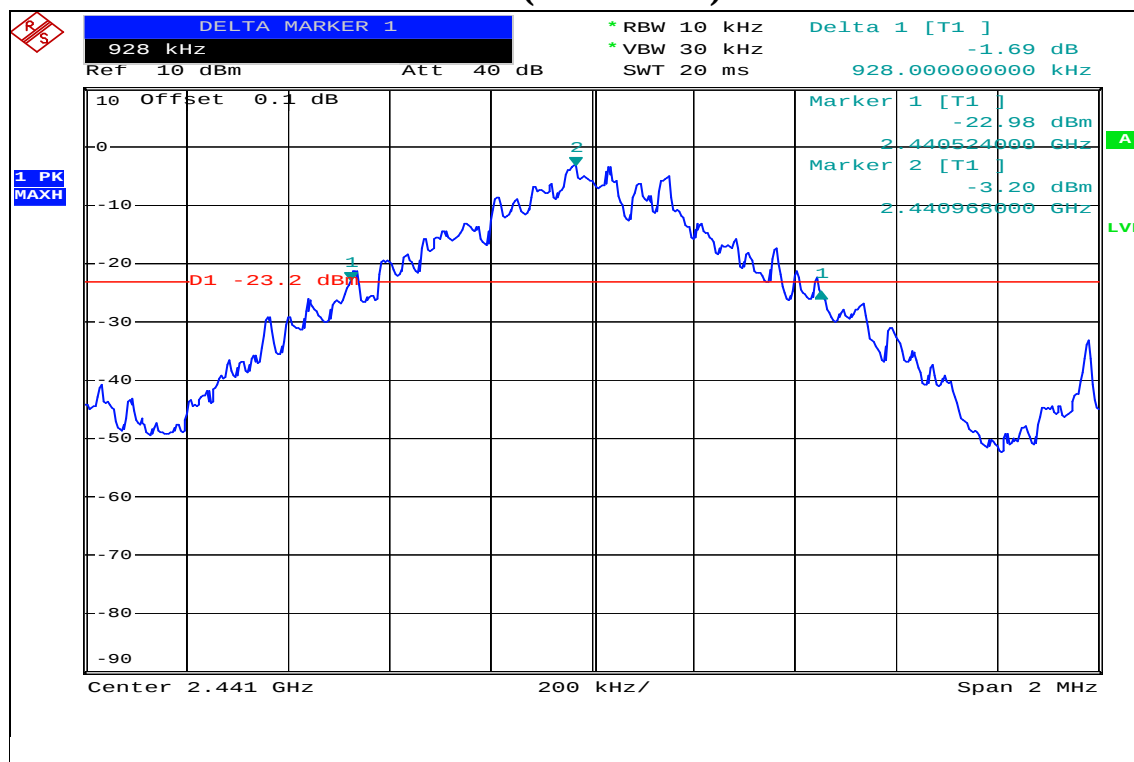
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20dB Band Width Test Data CH-Low (BDR mode)



20dB Band Width Test Data CH-Mid (BDR mode)



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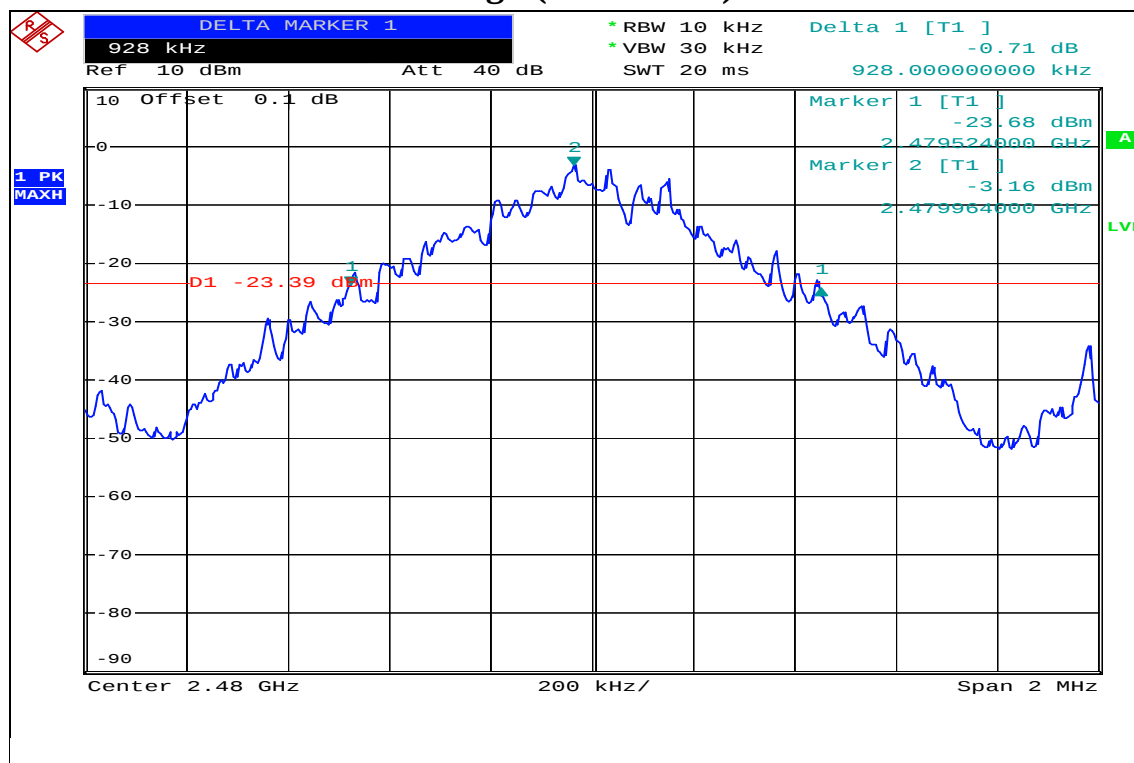
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20dB Band Width Test Data CH-High (BDR mode)



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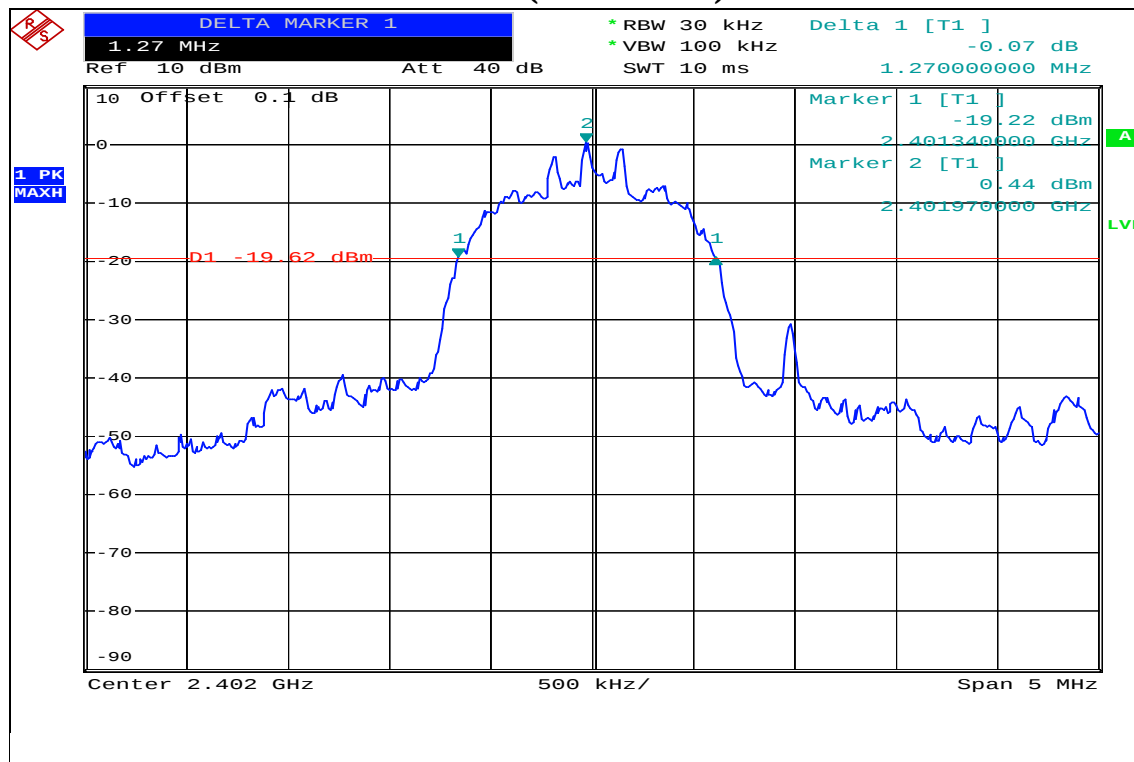
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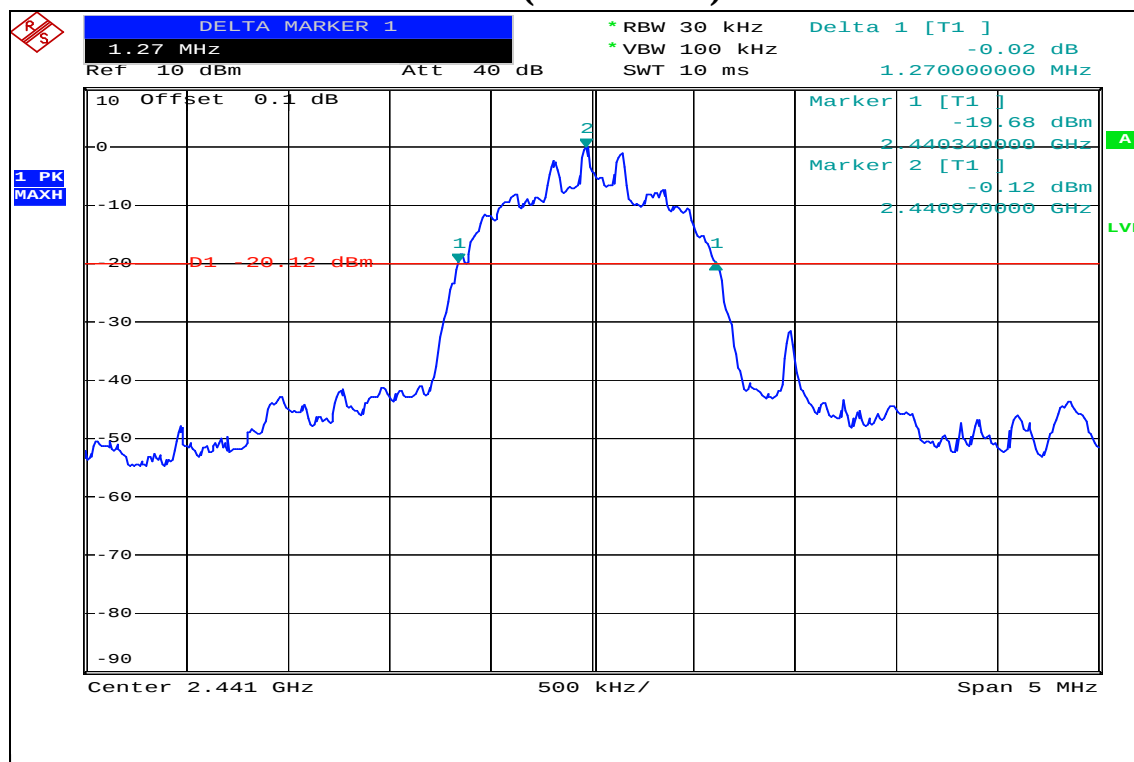
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20dB Band Width Test Data CH-Low (EDR mode)



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



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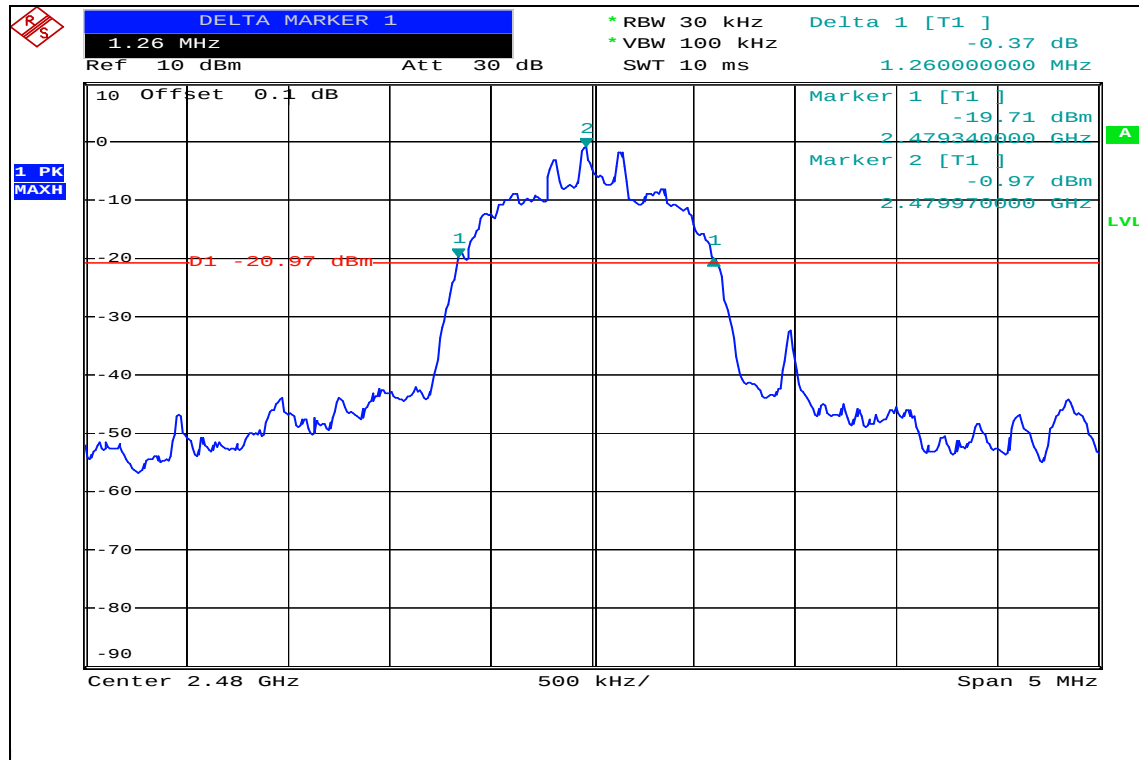
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20dB Band Width Test Data CH-High (EDR mode)



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9. 100KHz BANDWIDTH OF BAND EDGES MEASUREMENT

9.1. Standard Applicable

According to §15.247(c), in any 100 KHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100KHz 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 in §15.209(a).

9.2. Measurement Equipment Used

9.2.1. Conducted Emission at antenna port:

Refer to section 7.2 for details.

9.2.2. Radiated emission:

966 Chamber					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESCI7	100759	05/20/2011	05/19/2013
Spectrum Analyzer	Agilent	E4446A	MY51100003	04/15/2011	04/14/2013
EXA Spectrum Analyzer	Agilent	N9010A	MY50420195	02/15/2011	02/14/2013
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	01/04/2012	01/03/2013
Pre-Amplifier	EMC Instruments Corp.	EMC0126530	980038	01/04/2012	01/03/2013
Filter 2400-2483.5 MHz	EWT	EWT-14-0166	M2	02/28/2012	02/28/2013
Attenuator	Mini-Circuit	BW-S10W2+	004	02/28/2012	02/27/2013
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	01/04/2012	01/03/2013
3m Site NSA	SGS	966 chamber	N/A	07/15/2011	07/14/2012

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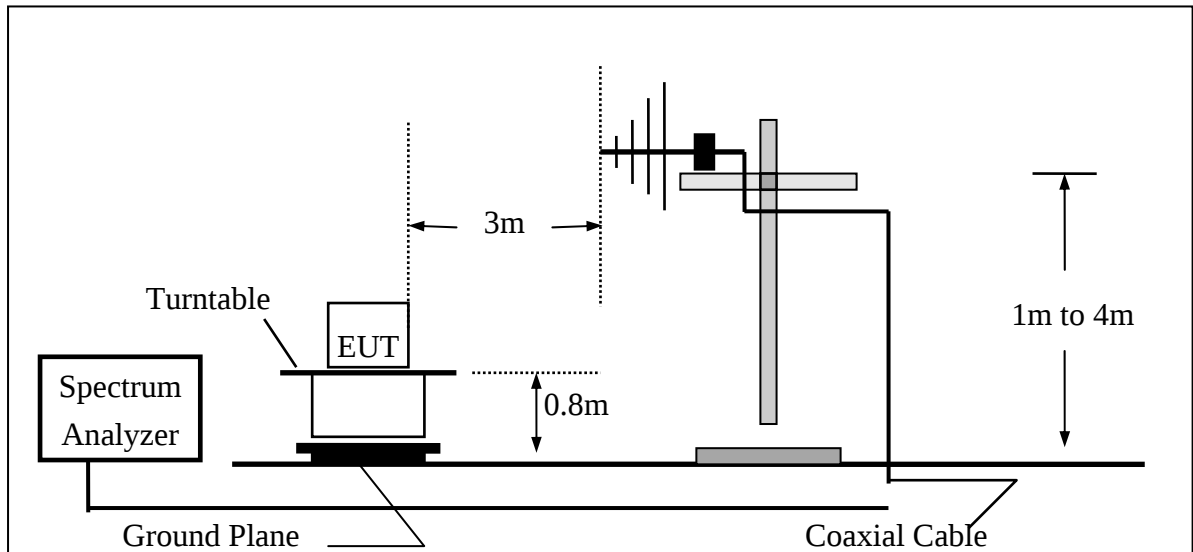
9.3. Test SET-UP:

9.3.1. Conducted Emission at antenna port:

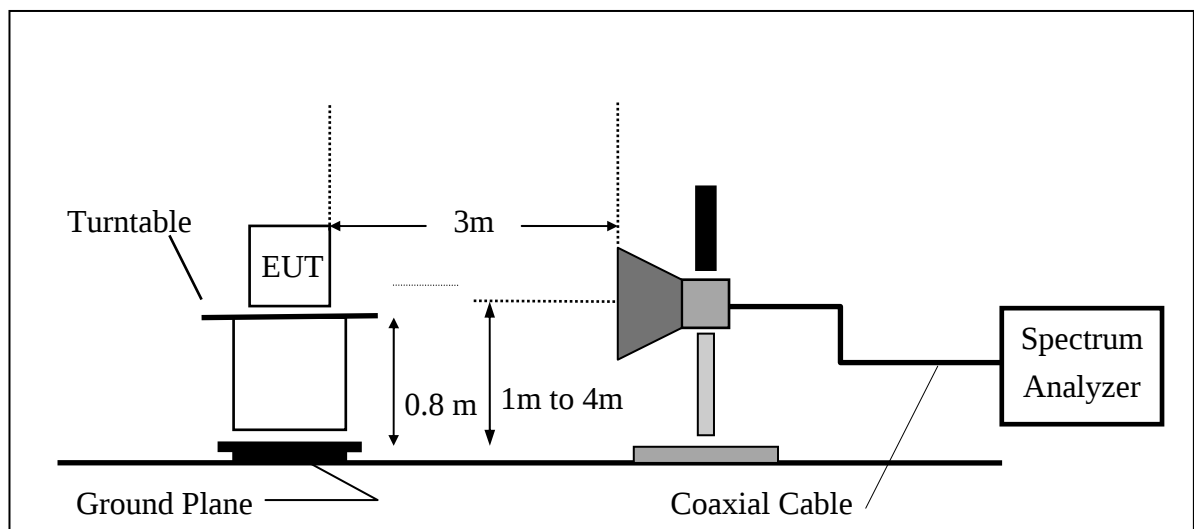
Refer to section 7.3 for details.

9.3.2. 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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9.4. 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=100KHz, Span=25MHz, 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.
7. Radiated Emission refer to section 9.

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

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

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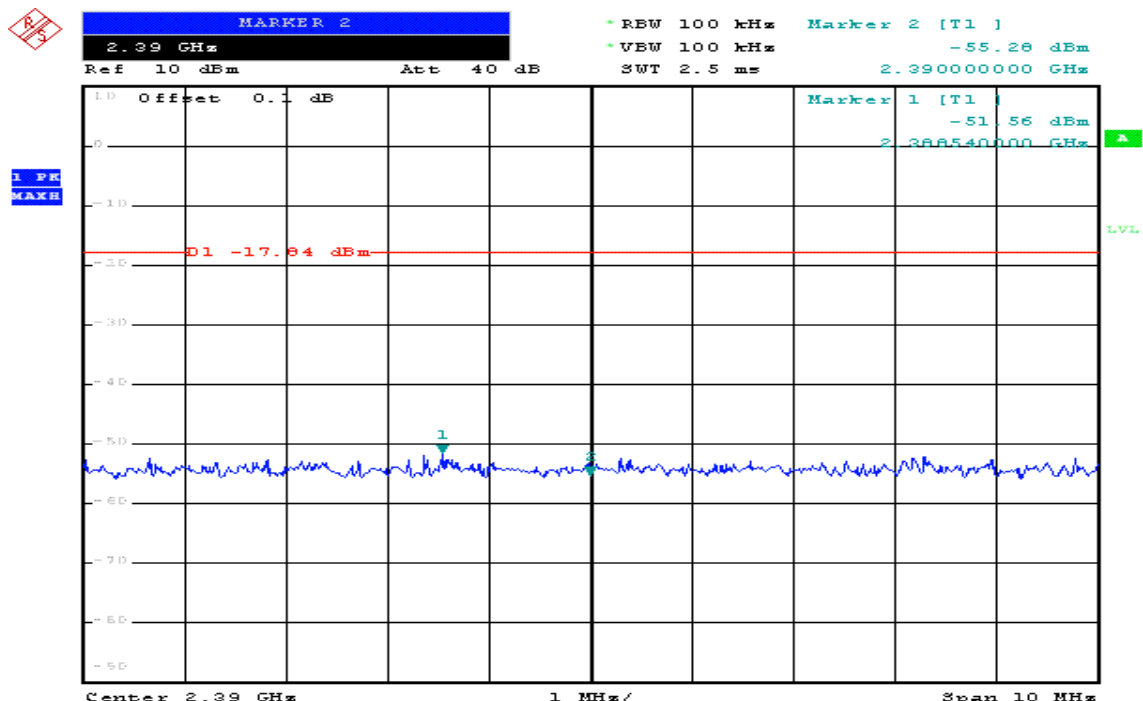
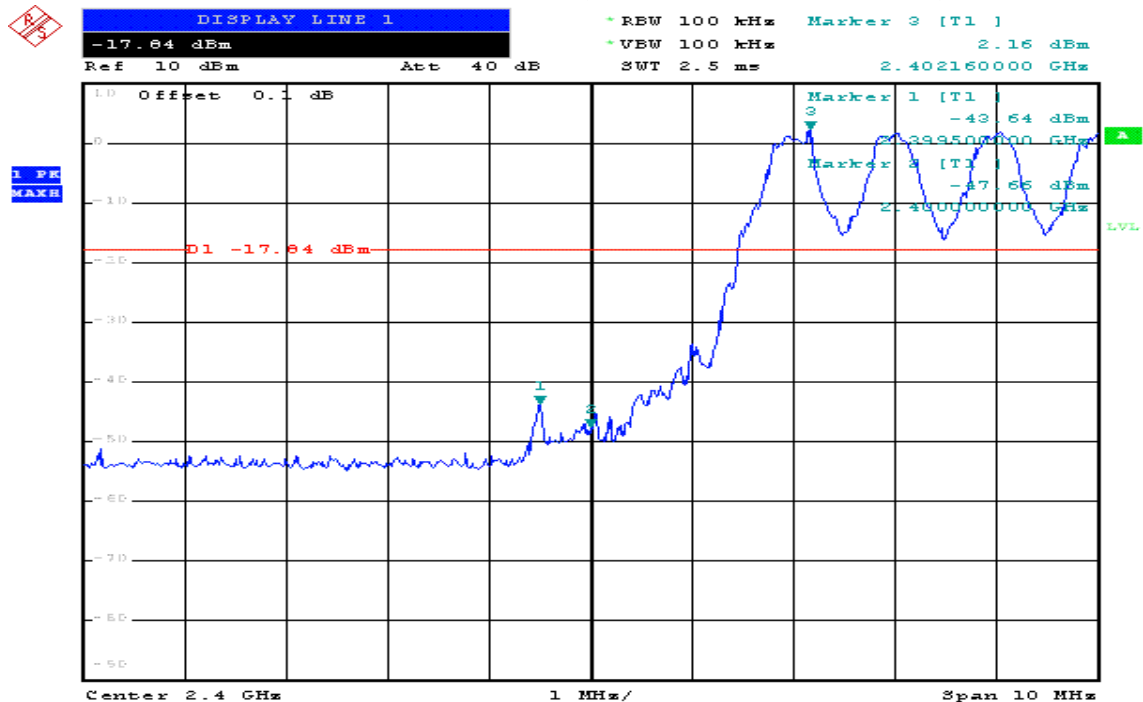
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Conducted Emission: Test Data CH-Low (worst case BDR mode)



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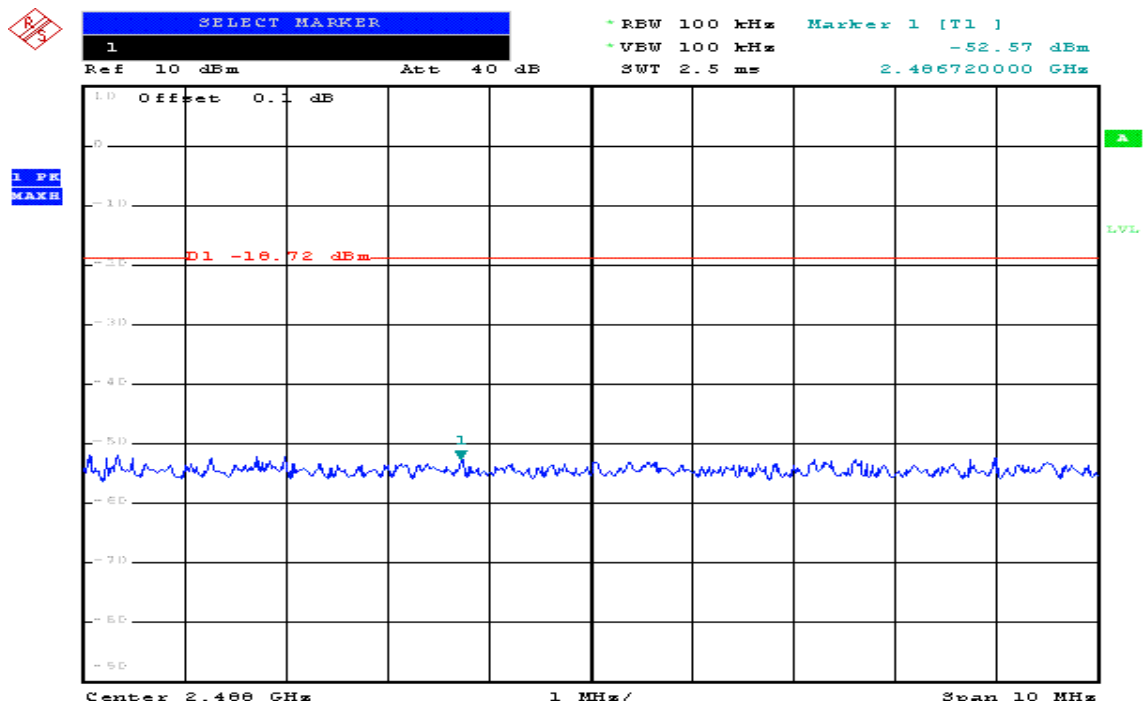
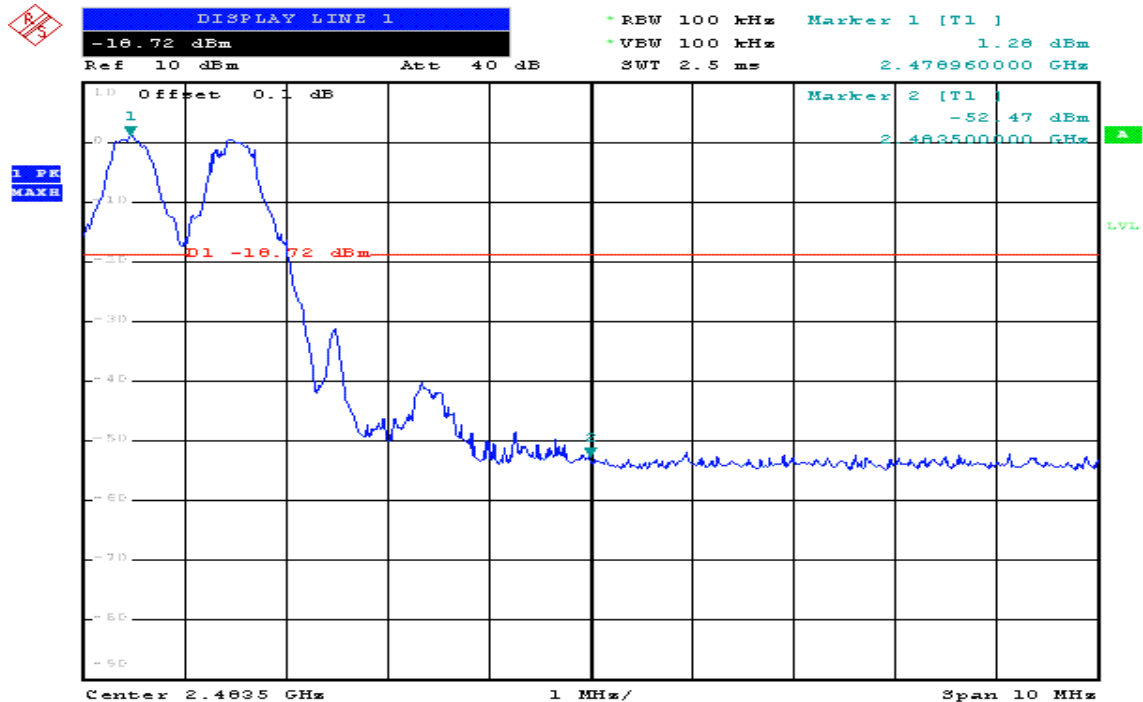
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Conducted Emission: Test Data CH-High



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Radiated Emission: (The worst case BDR mode)

Operation Band	:BDR	Test Date	:2012-05-15
Fundamental Frequency	:2402 MHz	Temp./Humi.	:27 deg_C / 66 RH
Operation Mode	:TX BANDEDGE	Engineer	:Marcus
EUT Pol.	:E2 plan	Measurement Antenna Pol.	:VERTICAL

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Safe Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2390.00	E	Average	28.76	4.68	33.44	54.00	-20.56
2390.00	E	Peak	40.43	4.68	45.11	74.00	-28.89

Operation Band	:BDR	Test Date	:2012-05-15
Fundamental Frequency	:2402 MHz	Temp./Humi.	:27 deg_C / 66 RH
Operation Mode	:TX BANDEDGE	Engineer	:Marcus
EUT Pol.	:E2 plan	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Safe Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2390.00	E	Average	28.41	5.30	33.71	54.00	-20.29
2390.00	E	Peak	40.89	5.30	46.19	74.00	-27.81

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Operation Band	:BDR	Test Date	:2012-05-15
Fundamental Frequency	:2480 MHz	Temp./Humi.	:27 deg_C / 66 RH
Operation Mode	:TX BANDEDGE	Engineer	:Marcus
EUT Pol.	:E2 plan	Measurement Antenna Pol.	:VERTICAL

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
		Mode	Reading Level		FS	@3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2483.50	E	Average	29.11	5.26	34.37	54.00	-19.63
2483.50	E	Peak	44.61	5.26	49.87	74.00	-24.13

Operation Band	:BDR	Test Date	:2012-05-15
Fundamental Frequency	:2480 MHz	Temp./Humi.	:27 deg_C / 66 RH
Operation Mode	:TX BANDEDGE	Engineer	:Marcus
EUT Pol.	:E2 plan	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
		Mode	Reading Level		FS	@3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2483.50	E	Average	28.86	6.29	35.15	54.00	-18.85
2483.50	E	Peak	41.24	6.29	47.53	74.00	-26.47

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10. SPURIOUS RADIATED EMISSION TEST

10.1. Standard Applicable

According to §15.247(c), all other emissions outside these bands shall not exceed the general radiated emission limits specified in §15.209(a). 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.

10.2. Measurement Equipment Used:

10.2.1. Conducted Emission at antenna port:

Refer to section 7.2 for details.

10.2.2. Radiated emission:

Refer to section 8.2 for details.

10.3. Test SET-UP:

10.3.1. Conducted Emission at antenna port:

Refer to section 7.3 for details.

10.3.2. Radiated emission:

Refer to section 8.3 for details.

10.4. Measurement Procedure:

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 measured were complete.

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Conducted Emission:

1. To connect Antenna Port of EUT to Spectrum.
2. Set RBW = 100K & VBW = 100K on Spectrum.
3. Sweep the frequency to determine spurious emission as seen on spectrum from span of 30 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 one plot

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	

10.6. Measurement Result:

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

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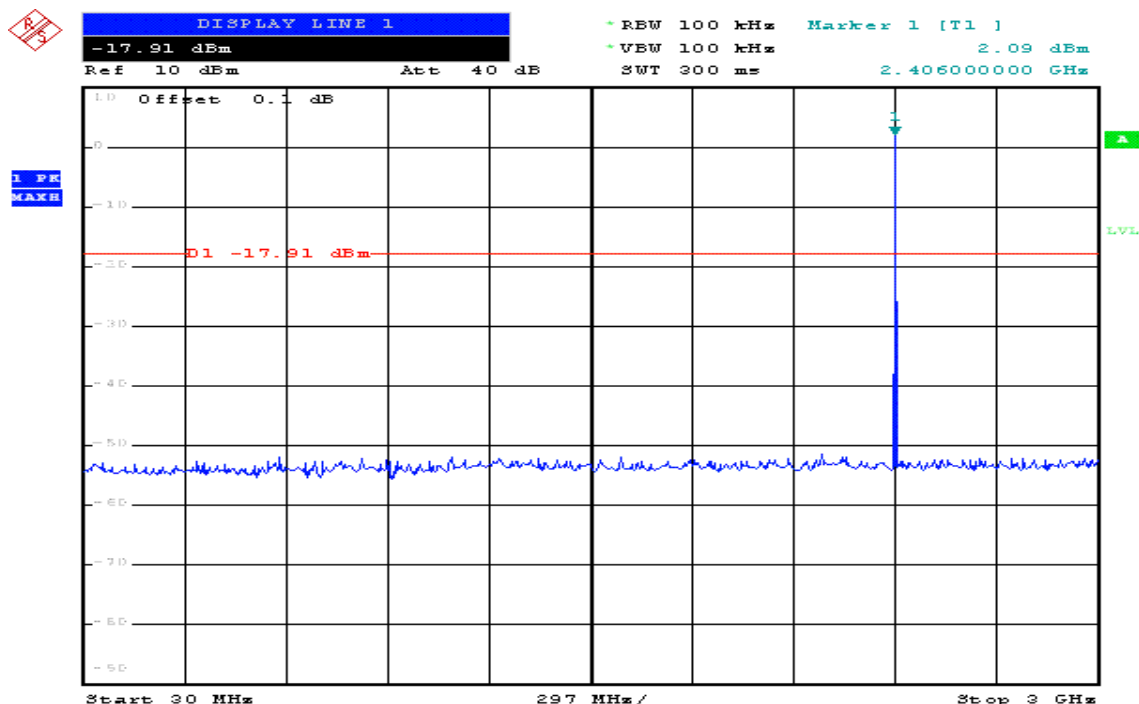
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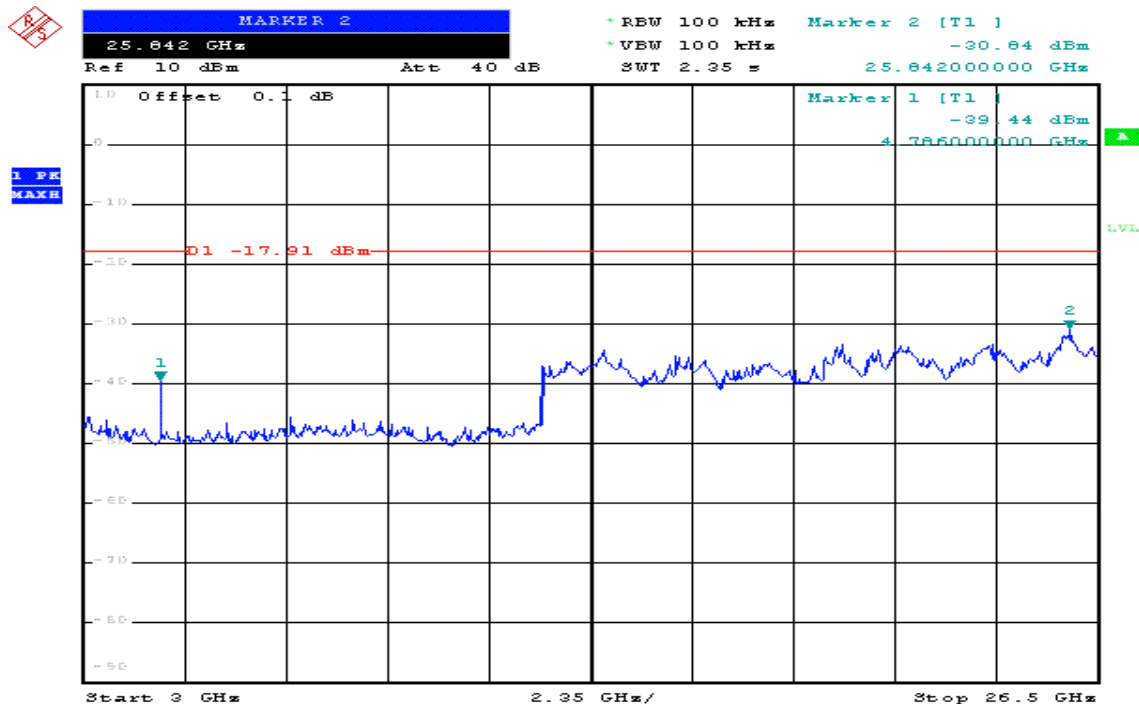
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Conducted Spurious Emission Measurement Result (BDR mode the worst case)

Ch Low 30MHz – 3GHz



Ch Low 3GHz – 26.5GHz

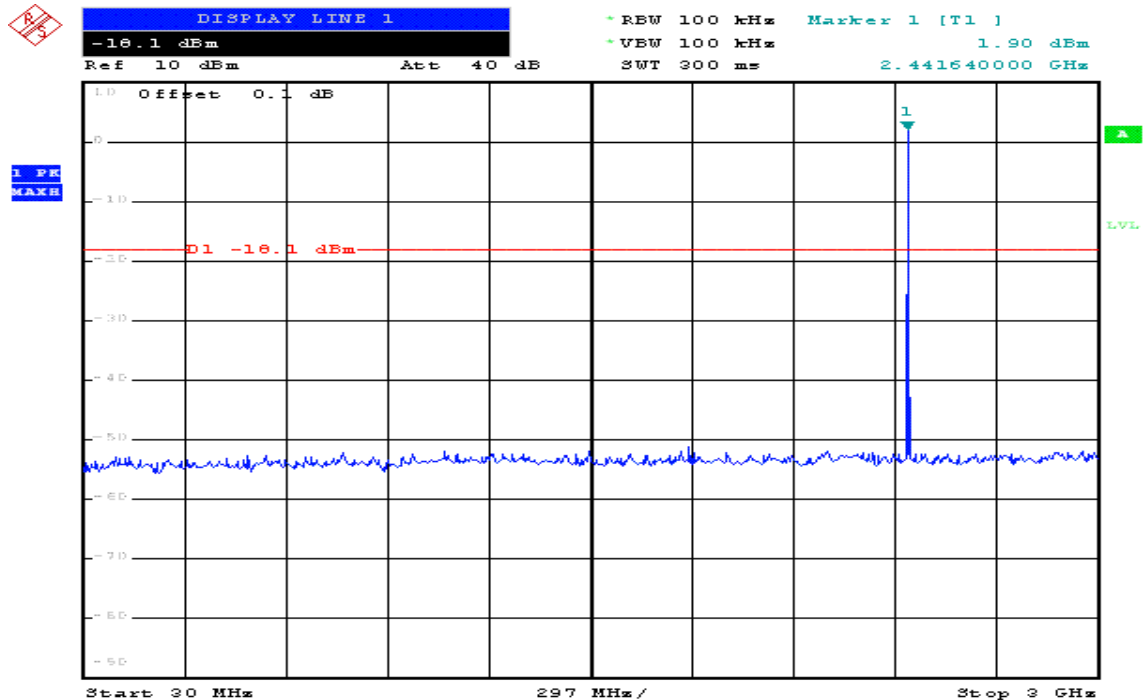


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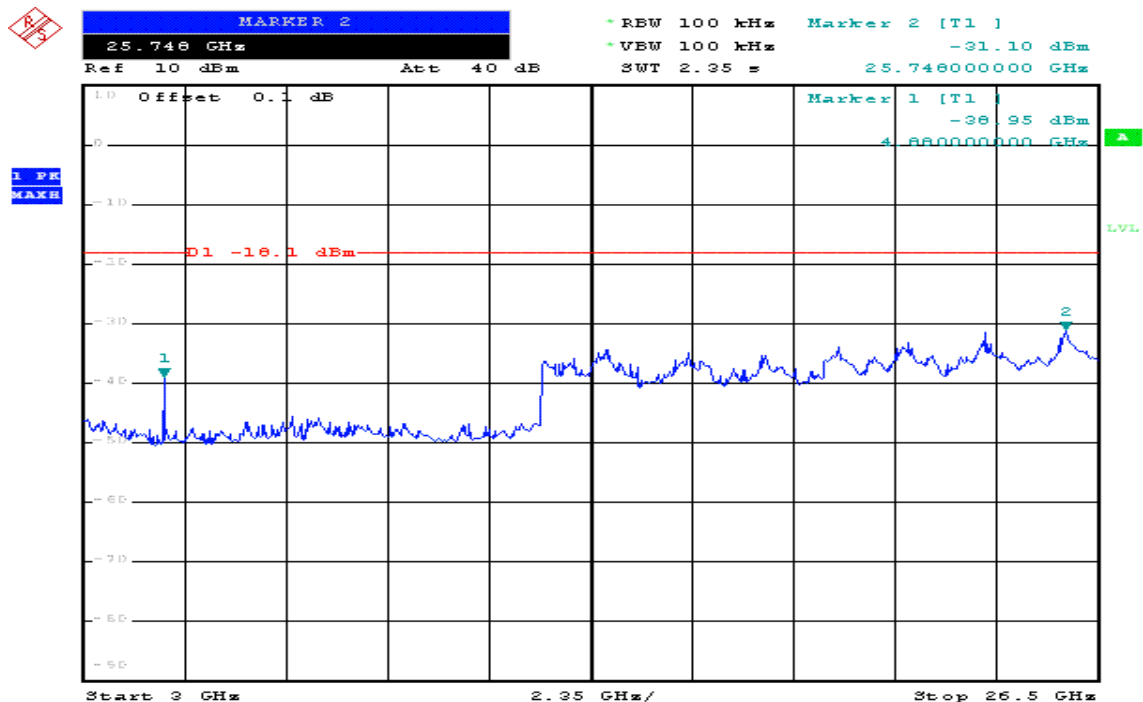
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Ch Mid 30MHz – 3GHz



Ch Mid 3GHz – 26.5GHz



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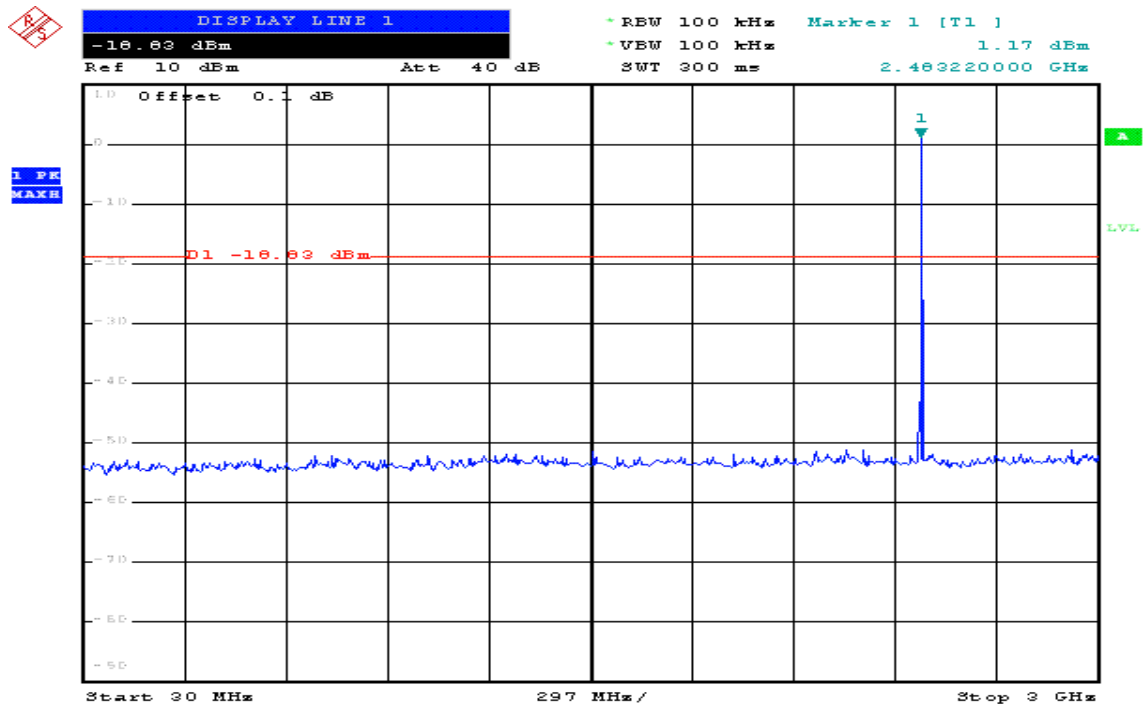
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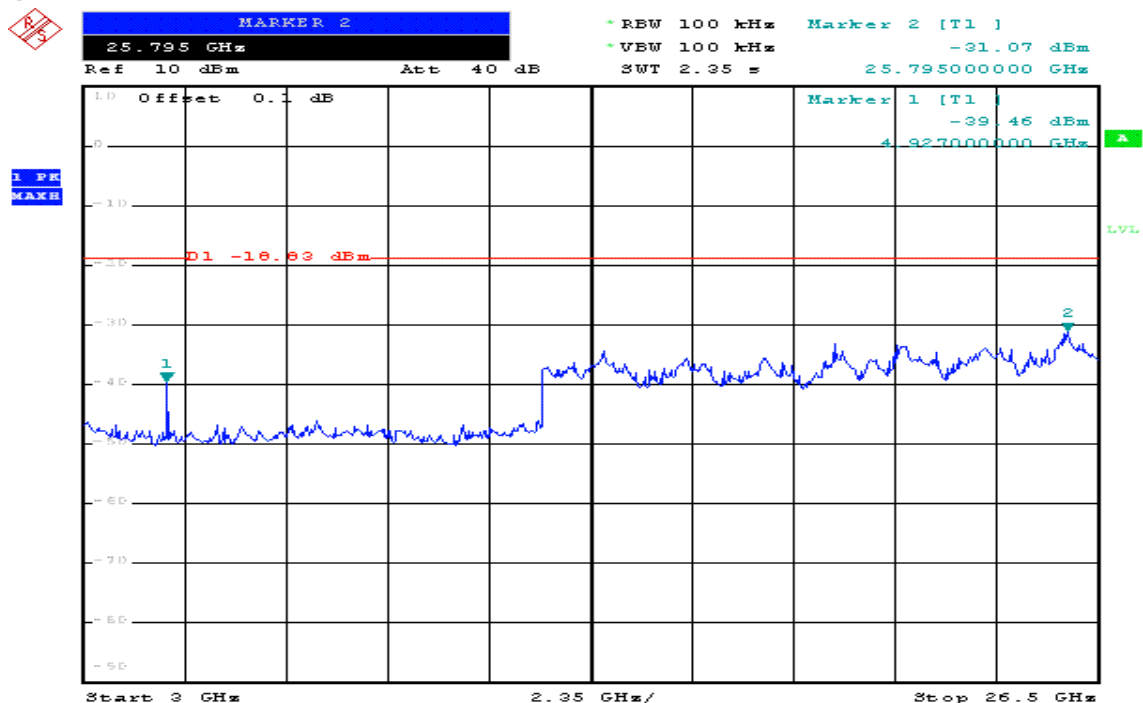
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Ch High 30MHz – 3GHz



Ch High 3GHz – 26.5GHz



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Radiated Spurious Emission Measurement Result (below 1GHz) (BDR mode the worst case)

Operation Band	:BDR	Test Date	:2012-05-15
Fundamental Frequency	:2402 MHz	Temp./Humi.	:27 deg_C / 66 RH
Operation Mode	:TX LOW	Engineer	:Marcus
EUT Pol.	:E2 plan	Measurement Antenna Pol.	:VERTICAL

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	Margin
		PK/QP/AV	dBμV		dBμV/m	dBμV/m	dB
166.77	S	Peak	45.09	-12.87	32.22	43.50	-11.28
325.85	S	Peak	51.64	-11.98	39.66	46.00	-6.34
579.99	S	Peak	42.01	-7.99	34.02	46.00	-11.98
623.64	S	Peak	41.25	-7.05	34.20	46.00	-11.80
741.98	S	Peak	36.49	-5.10	31.39	46.00	-14.61
909.79	S	Peak	36.21	-2.62	33.59	46.00	-12.41
1604.50	S	Peak	44.68	0.38	45.06	74.00	-28.94
4804.00	H	Average	38.16	9.65	47.81	54.00	-6.19
4804.00	H	Peak	44.47	9.65	54.12	74.00	-19.88
7206.00	H	---					
9608.00	H	---					
12010.00	H	---					
14412.00	H	---					
16814.00	H	---					
19216.00	H	---					
21618.00	H	---					
24020.00	H	---					

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Operation Band	:BDR	Test Date	:2012-05-15
Fundamental Frequency	:2402 MHz	Temp./Humi.	:27 deg_C / 66 RH
Operation Mode	:TX LOW	Engineer	:Marcus
EUT Pol.	:E2 plan	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	Margin
		PK/QP/AV	dBμV		dBμV/m	dBμV/m	dB
166.77	S	Peak	50.81	-12.87	37.94	43.50	-5.56
249.22	S	Peak	54.59	-14.02	40.57	46.00	-5.43
367.56	S	Peak	54.47	-11.46	43.01	46.00	-2.99
411.21	S	Peak	51.54	-10.82	40.72	46.00	-5.28
701.24	S	Peak	44.65	-5.73	38.92	46.00	-7.08
888.45	S	Peak	42.39	-3.04	39.35	46.00	-6.65
1604.50	S	Peak	49.72	0.98	50.70	74.00	-23.30
4804.00	H	Average	39.05	9.69	48.74	54.00	-5.26
4804.00	H	Peak	43.78	9.69	53.47	74.00	-20.53
7206.00	H	---					
9608.00	H	---					
12010.00	H	---					
14412.00	H	---					
16814.00	H	---					
19216.00	H	---					
21618.00	H	---					
24020.00	H	---					

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Operation Band	:BDR	Test Date	:2012-05-15
Fundamental Frequency	:2441 MHz	Temp./Humi.	:27 deg_C / 66 RH
Operation Mode	:TX MID	Engineer	:Marcus
EUT Pol.	:E2 plan	Measurement Antenna Pol.	:VERTICAL

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	Margin
		PK/QP/AV	dBμV		dBμV/m	dBμV/m	dB
166.77	S	Peak	46.35	-12.87	33.48	43.50	-10.02
251.16	S	Peak	50.15	-13.99	36.16	46.00	-9.84
322.94	S	Peak	52.50	-12.03	40.47	46.00	-5.53
500.45	S	Peak	42.52	-9.58	32.94	46.00	-13.06
614.91	S	Peak	41.87	-7.23	34.64	46.00	-11.36
892.33	S	Peak	36.85	-2.97	33.88	46.00	-12.12
1624.00	S	Peak	46.02	0.59	46.61	74.00	-27.39
4882.00	H	Peak	40.65	10.16	50.81	74.00	-23.19
7323.00	H	---					
9764.00	H	---					
12205.00	H	---					
14646.00	H	---					
17087.00	H	---					
19528.00	H	---					
21969.00	H	---					
24410.00	H	---					

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Operation Band	:BDR	Test Date	:2012-05-15
Fundamental Frequency	:2441 MHz	Temp./Humi.	:27 deg_C / 66 RH
Operation Mode	:TX MID	Engineer	:Marcus
EUT Pol.	:E2 plan	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	Margin
		PK/QP/AV	dBμV		dBμV/m	dBμV/m	dB
148.34	S	Peak	46.16	-12.45	33.71	43.50	-9.79
249.22	S	Peak	53.87	-14.02	39.85	46.00	-6.15
332.64	S	Peak	54.40	-11.89	42.51	46.00	-3.49
409.27	S	Peak	53.09	-10.87	42.22	46.00	-3.78
709.00	S	Peak	44.57	-5.60	38.97	46.00	-7.03
899.12	S	Peak	42.42	-2.83	39.59	46.00	-6.41
1624.00	S	Average	48.56	1.30	49.86	54.00	-4.14
1624.00	S	Peak	48.68	1.30	49.98	74.00	-24.02
4882.00	H	Peak	37.85	10.11	47.96	74.00	-26.04
7323.00	H	---					
9764.00	H	---					
12205.00	H	---					
14646.00	H	---					
17087.00	H	---					
19528.00	H	---					
21969.00	H	---					
24410.00	H	---					

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Operation Band	:BDR	Test Date	:2012-05-15
Fundamental Frequency	:2480 MHz	Temp./Humi.	:27 deg_C / 66 RH
Operation Mode	:TX HIGH	Engineer	:Marcus
EUT Pol.	:E2 plan	Measurement Antenna Pol.	:VERTICAL

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	Margin
		PK/QP/AV	dBμV		dBμV/m	dBμV/m	dB
166.77	S	Peak	43.18	-12.87	30.31	43.50	-13.19
247.28	S	Peak	49.05	-14.06	34.99	46.00	-11.01
323.91	S	Peak	50.64	-12.02	38.62	46.00	-7.38
592.60	S	Peak	43.32	-7.72	35.60	46.00	-10.40
623.64	S	Peak	42.11	-7.05	35.06	46.00	-10.94
903.00	S	Peak	38.83	-2.75	36.08	46.00	-9.92
1650.00	S	Peak	47.61	0.82	48.43	74.00	-25.57
4960.00	H	Peak	39.60	10.03	49.63	74.00	-24.37
7440.00	H	---					
9920.00	H	---					
12400.00	H	---					
14880.00	H	---					
17360.00	H	---					
19840.00	H	---					
22320.00	H	---					
24800.00	H	---					

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Operation Band	:BDR	Test Date	:2012-05-15
Fundamental Frequency	:2480 MHz	Temp./Humi.	:27 deg_C / 66 RH
Operation Mode	:TX HIGH	Engineer	:Marcus
EUT Pol.	:E2 plan	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	Margin
		PK/QP/AV	dBμV		dBμV/m	dBμV/m	dB
249.22	S	Peak	53.68	-14.02	39.66	46.00	-6.34
322.94	S	Peak	55.26	-12.03	43.23	46.00	-2.77
410.24	S	Peak	51.56	-10.84	40.72	46.00	-5.28
612.00	S	Peak	41.94	-7.30	34.64	46.00	-11.36
704.15	S	Peak	43.50	-5.68	37.82	46.00	-8.18
897.18	S	Peak	42.63	-2.87	39.76	46.00	-6.24
1650.00	S	Average	46.94	1.62	48.56	54.00	-5.44
1650.00	S	Peak	47.41	1.62	49.03	74.00	-24.97
4960.00	H	Peak	38.78	9.88	48.66	74.00	-25.34
7440.00	H	---					
9920.00	H	---					
12400.00	H	---					
14880.00	H	---					
17360.00	H	---					
19840.00	H	---					
22320.00	H	---					
24800.00	H	---					

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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 25KHz or the $2/3 \times 20\text{dB}$ bandwidth of the hopping channel, whichever is greater.

11.2. Measurement Equipment Used:

Refer to section 7.2 for details.

11.3. Test Set-up:

Refer to section 7.3 for details.

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=100KHz, Adjust Span to 3.0 MHz, 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	$\geq 25\text{KHz}$ or $2/3$ times 20dB bandwidth	PASS

Note: Refer to next page for plots.

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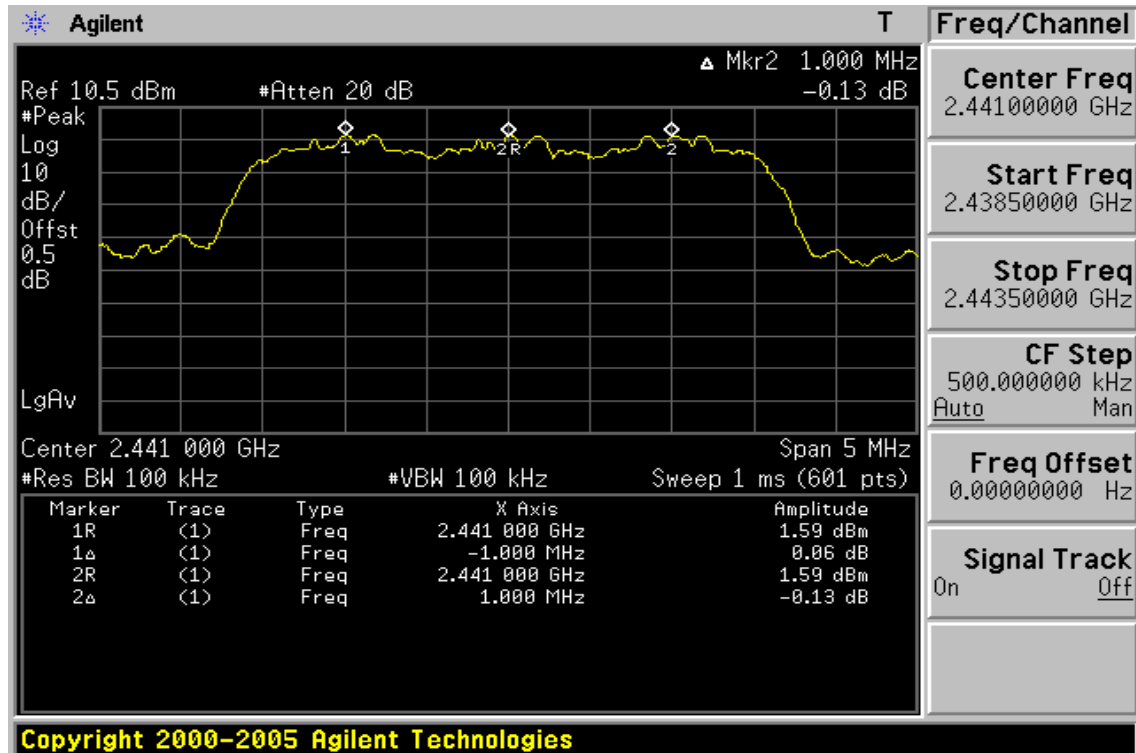
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Frequency Separation Test Data



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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:

Refer to section 7.2 for details.

12.3. Test Set-up:

Refer to section 7.3 for details.

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=430KHz,, VBW=1MHz.
5. Max hold, view and count how many channel in the band.

12.5. Measurement Result:

Note: Refer to next page for plots.

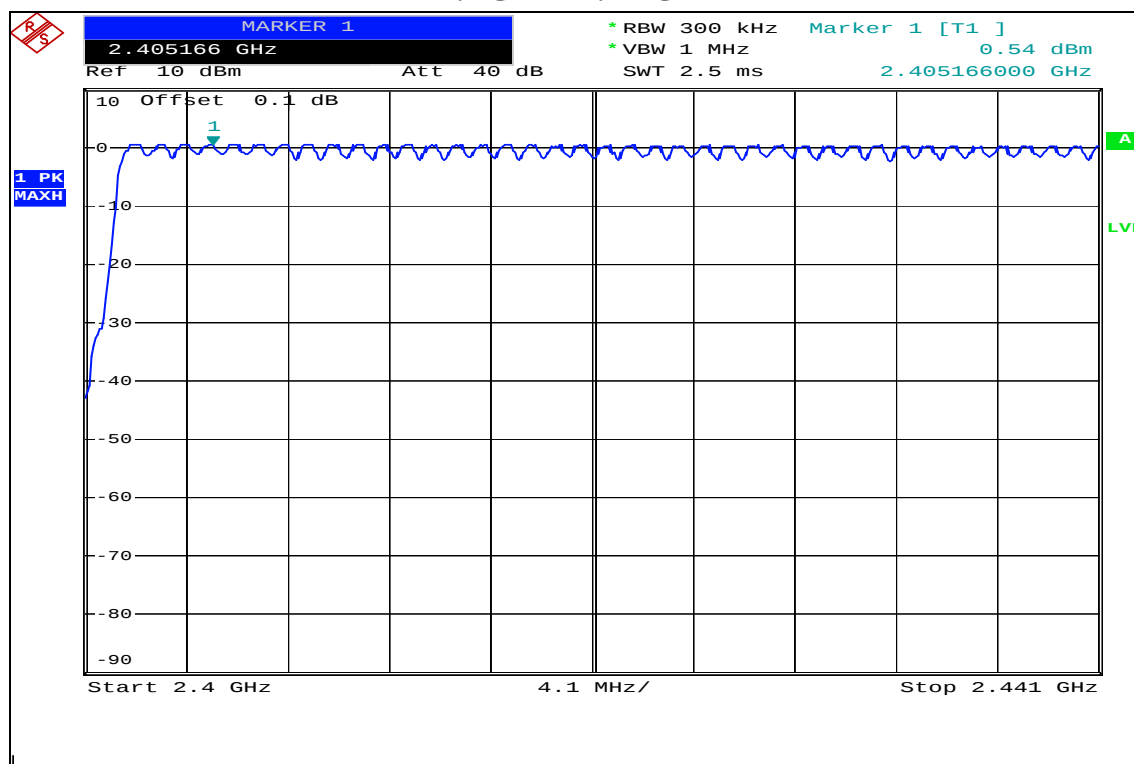
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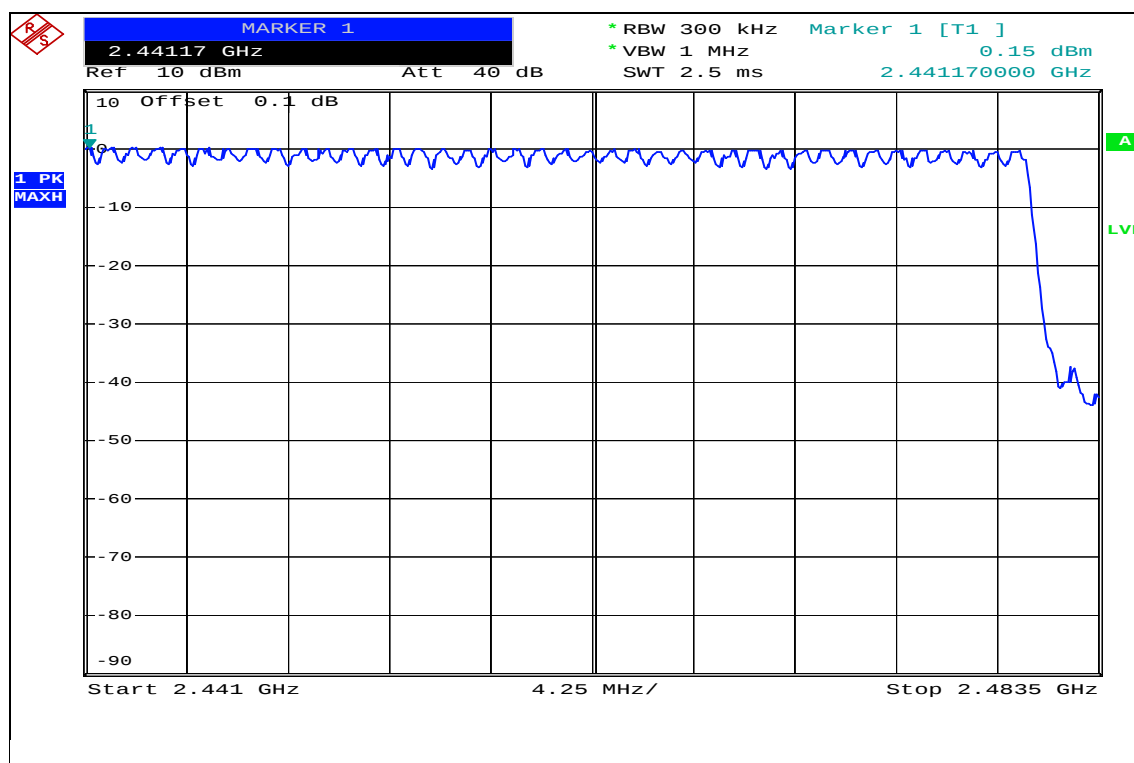
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Channel Number

2.4 GHz – 2.441GHz



2.441 GHz – 2.4835GHz



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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:

Refer to section 7.2 for details.

13.3. Test Set-up:

Refer to section 7.3 for details.

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=100KHz, Span = 0Hz , Adjust Sweep = 2~7ms.
5. Repeat above procedures until all frequency measured were complete.

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13.5. Measurement Result

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

CH Low: DH1 time slot = 1.260 (ms) * (1600/(2*79)) * 31.6 = 403.20(ms)

DH3 time slot = 2.500 (ms) * (1600/(4*79)) * 31.6 = 400.00(ms)

DH5 time slot = 3.760 (ms) * (1600/(6*79)) * 31.6 = 401.07(ms)

CH Mid: DH1 time slot = 1.260 (ms) * (1600/(2*79)) * 31.6 = 403.20(ms)

DH3 time slot = 2.500 (ms) * (1600/(4*79)) * 31.6 = 400.00(ms)

DH5 time slot = 3.760 (ms) * (1600/(6*79)) * 31.6 = 401.07(ms)

CH High: DH1 time slot = 1.256 (ms) * (1600/(2*79)) * 31.6 = 401.92(ms)

DH3 time slot = 2.514 (ms) * (1600/(4*79)) * 31.6 = 402.24(ms)

DH5 time slot = 3.760 (ms) * (1600/(6*79)) * 31.6 = 401.07(ms)

Note: Refer to next page for plots.

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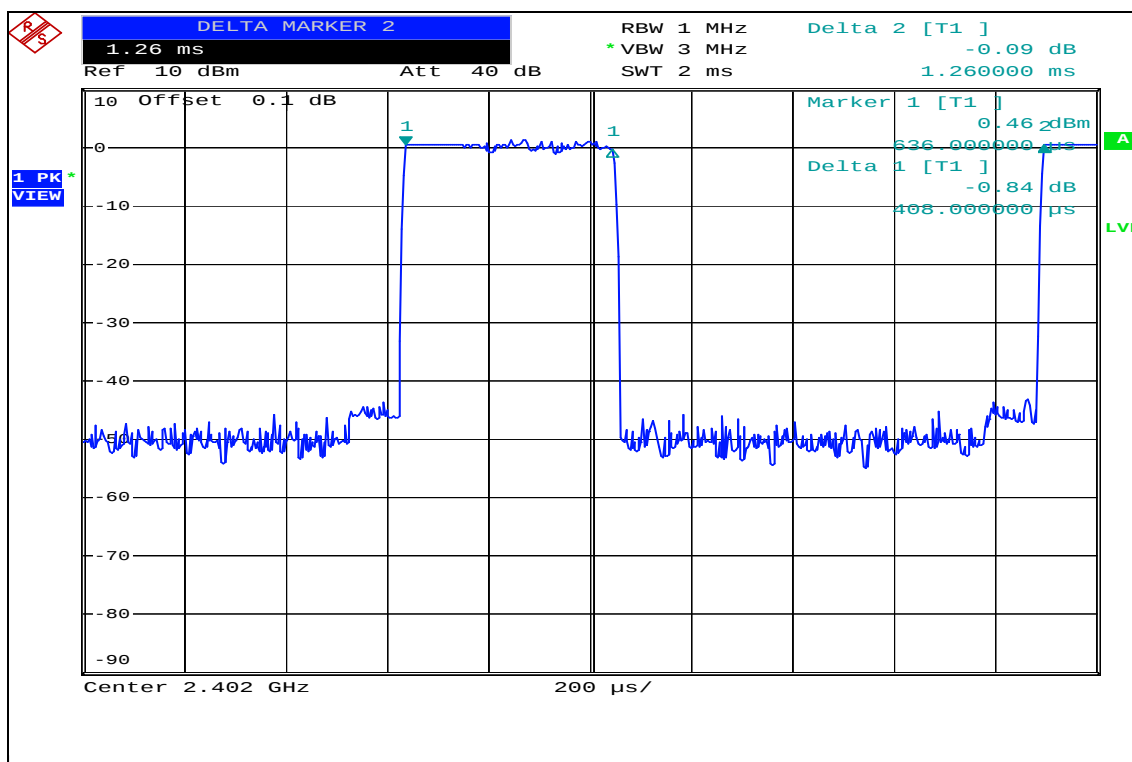
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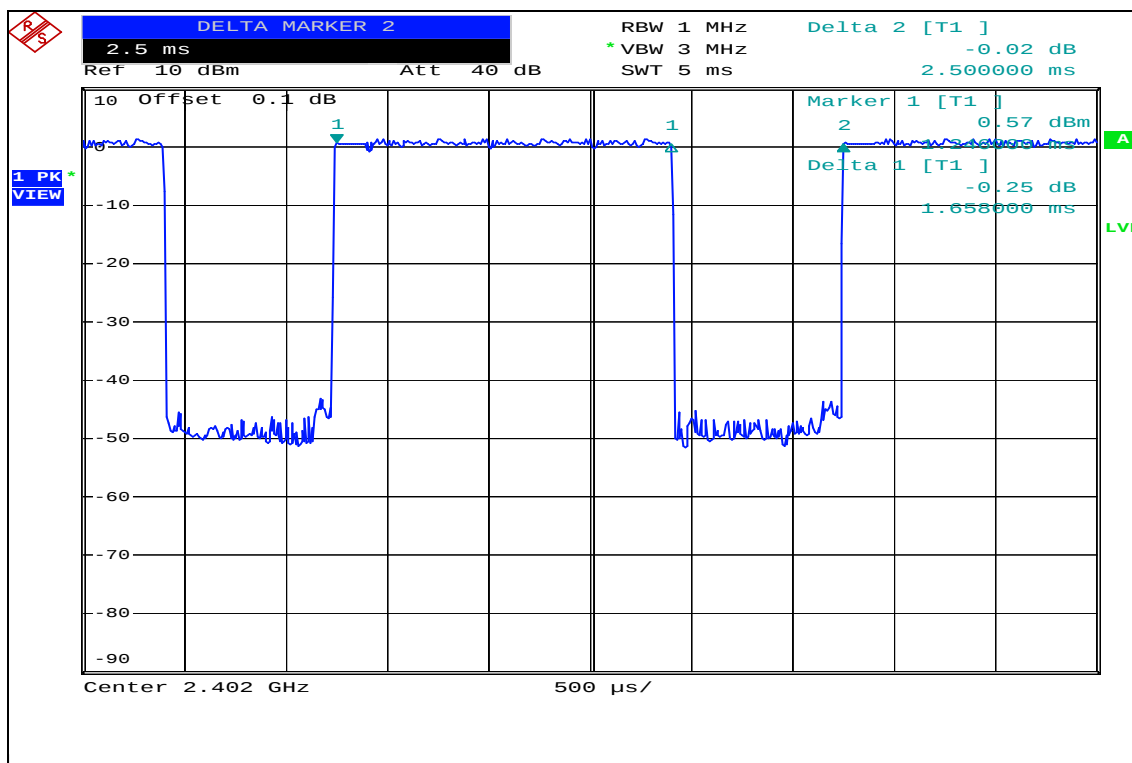
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CH-Low DH1



DH3



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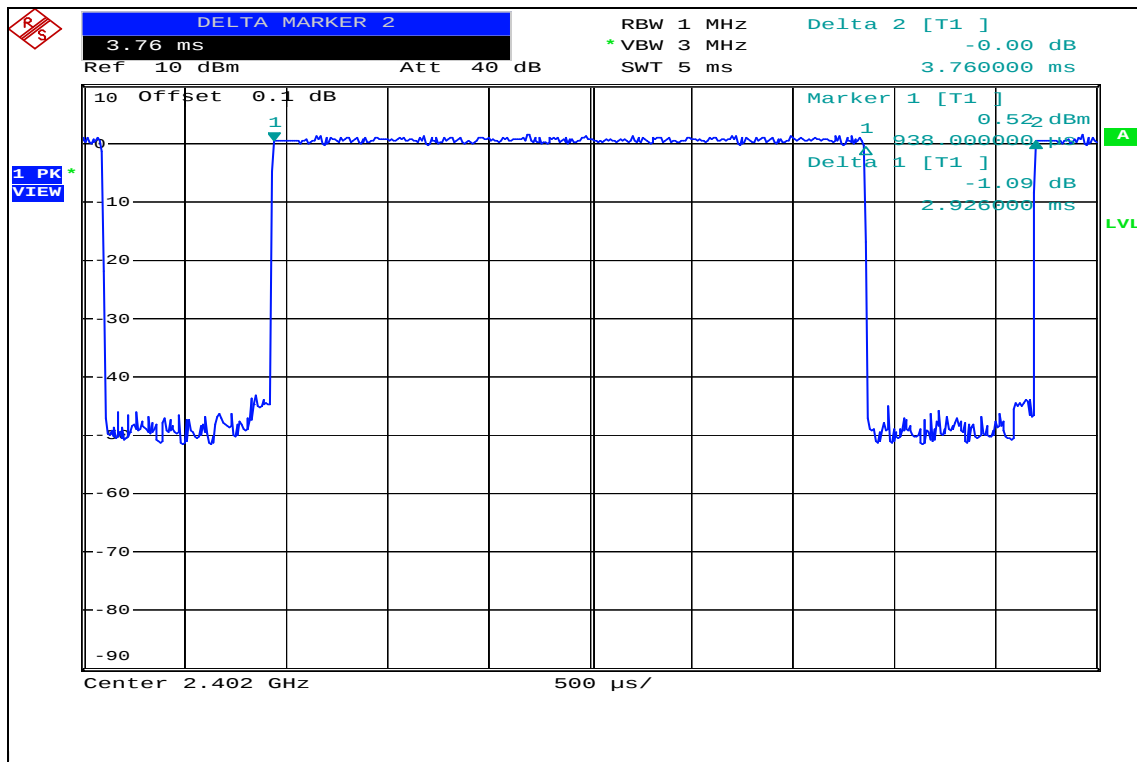
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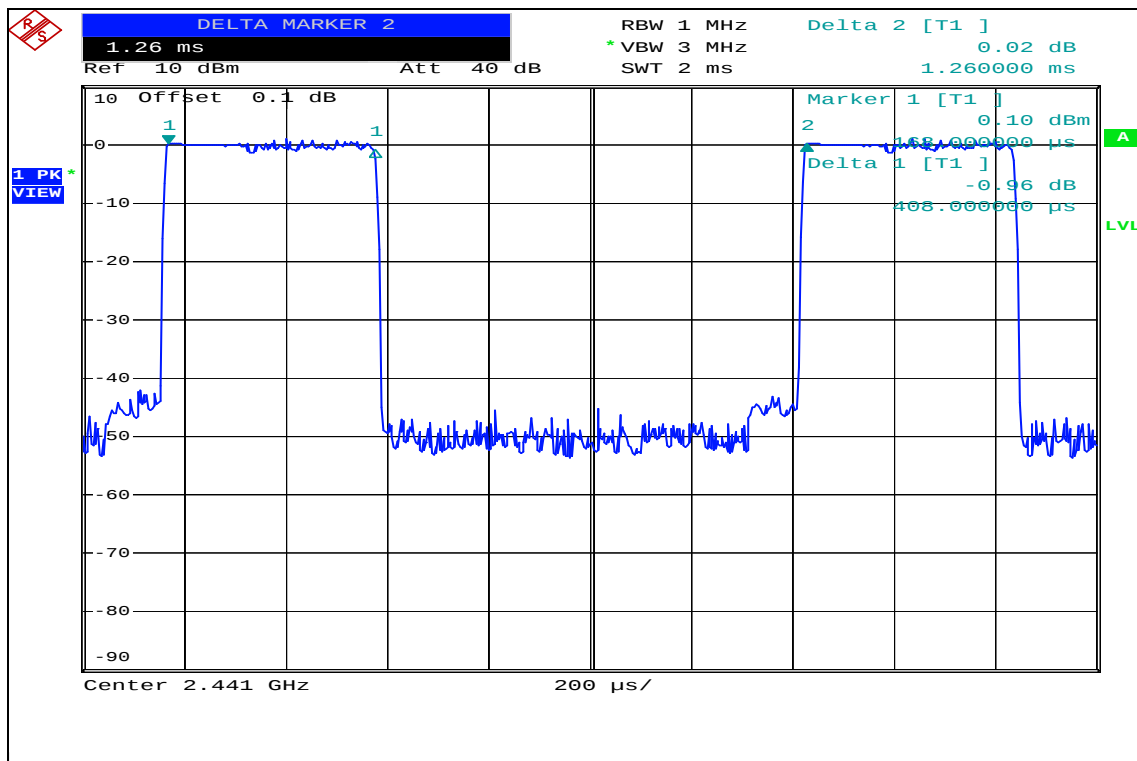
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DH5



CH-Mid

DH1



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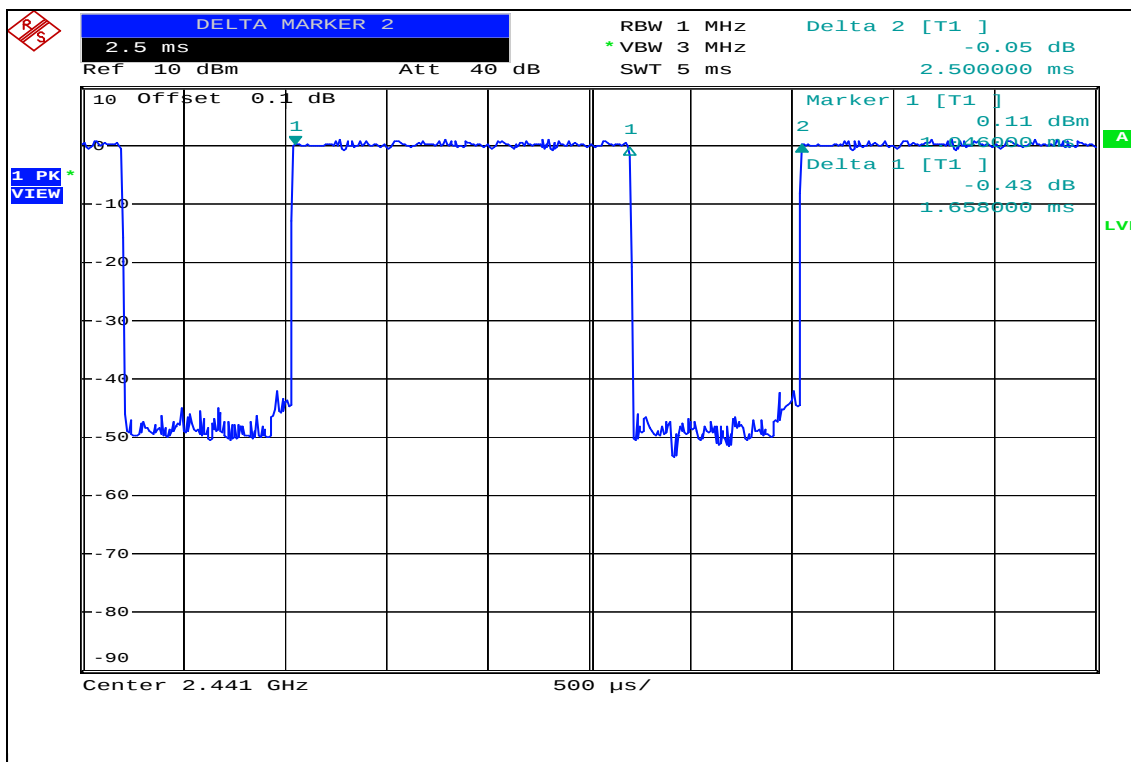
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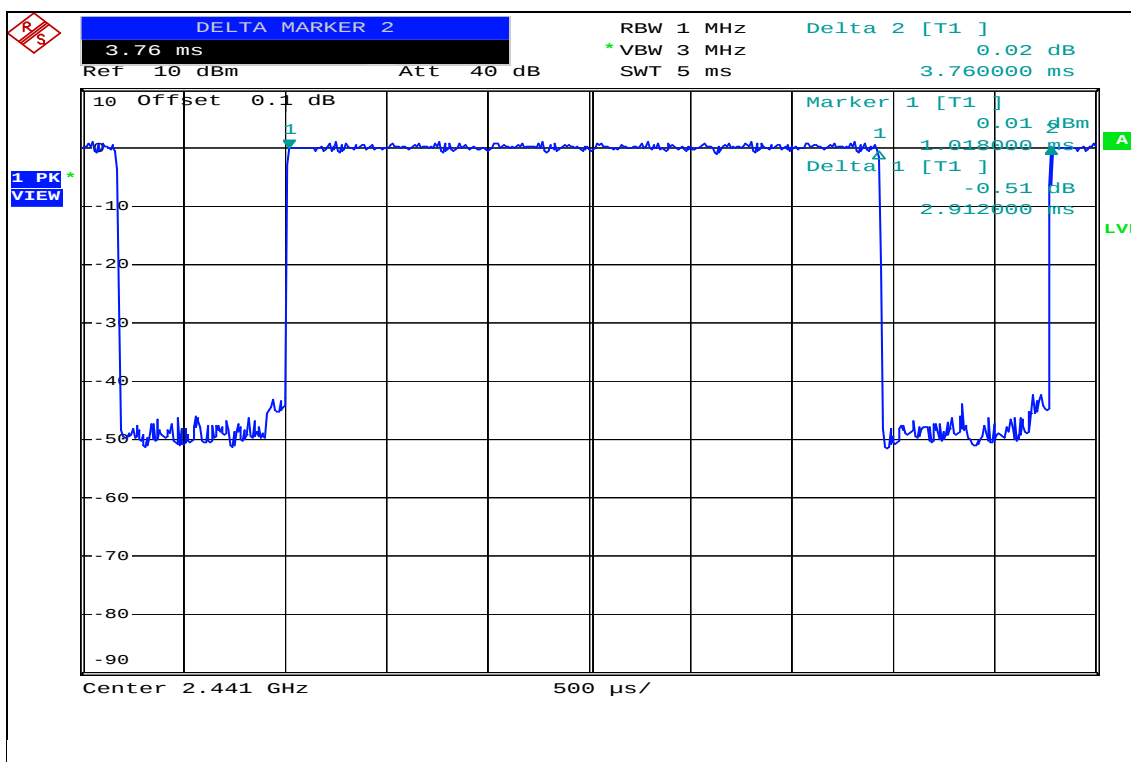
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DH3



DH5



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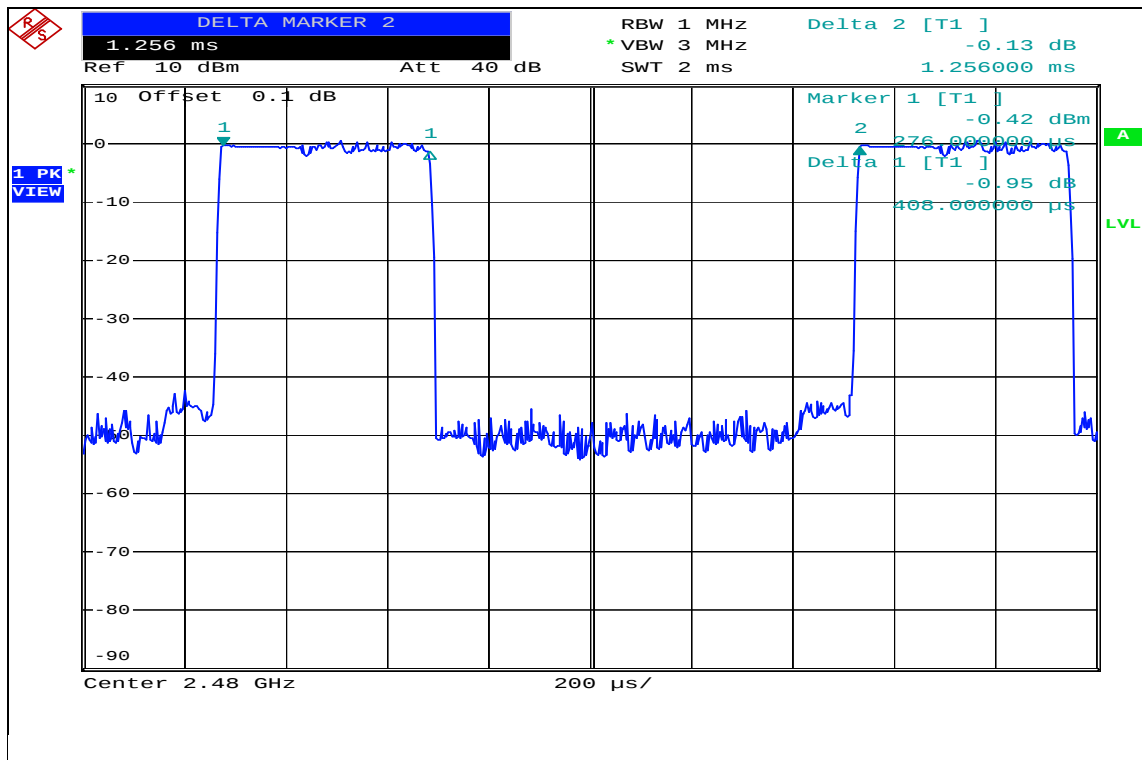
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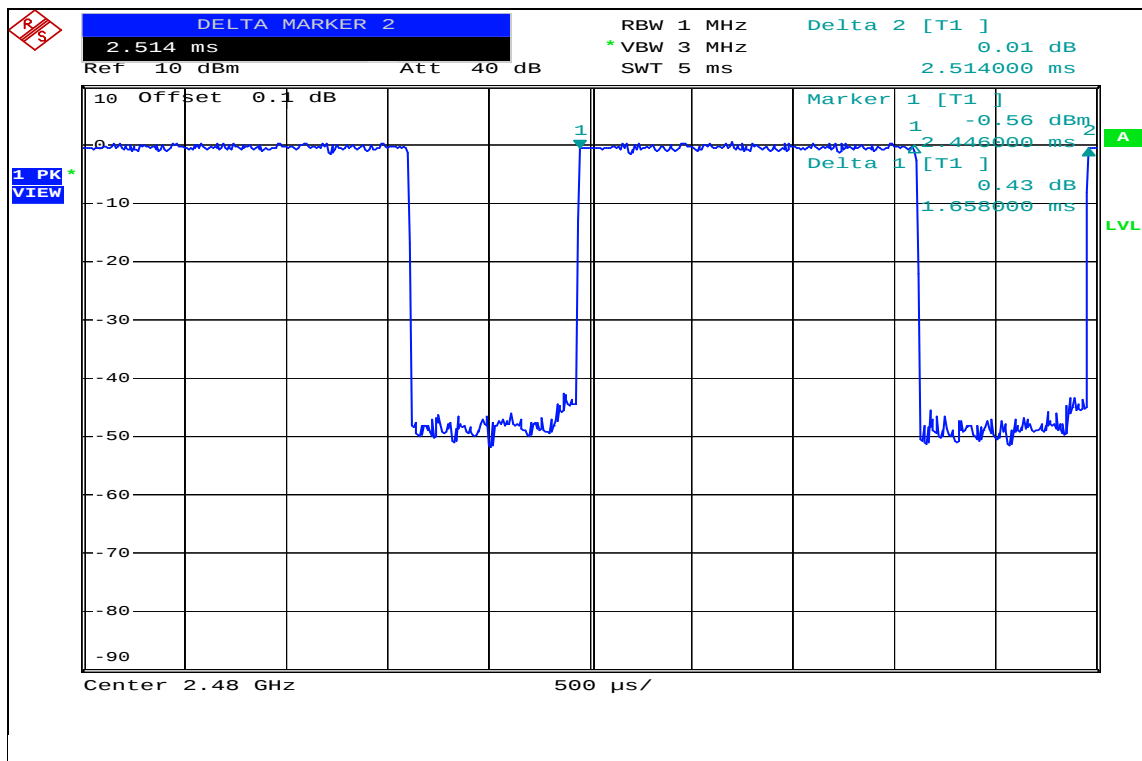
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CH-High DH1



DH3



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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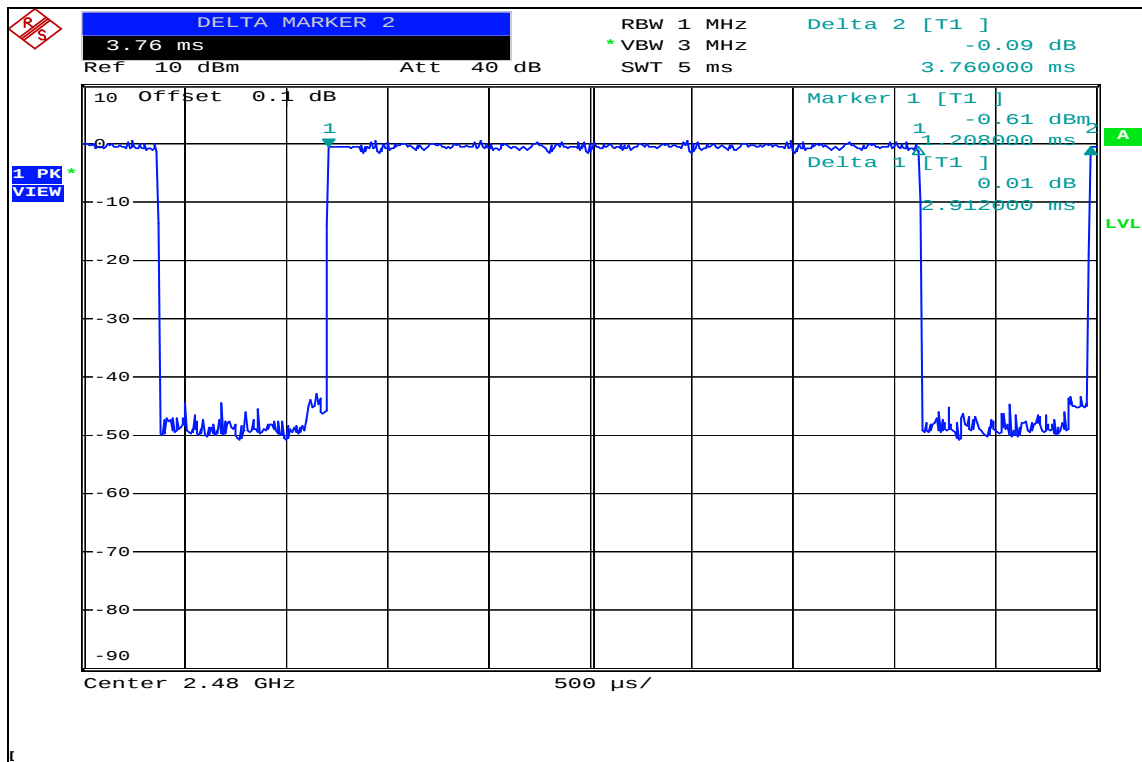
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DH5



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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.

And according to §15.247(4)(1), system operating in the 2400-2483.5MHz bands that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

14.2. Antenna Connected Construction

The directional gains of antenna used for transmitting is 2 dBi, and the antenna connector is designed with permanent attachment and no consideration of replacement. Please see EUT photo for details.

~ End of Report ~

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