

Prüfbericht - Nr.: 14009282 001		Seite 1 von 14	
Test Report No.		Page 1 of 14	
Auftraggeber: Applicant	i.Tech Dynamics Ltd. Room 1112, Metroplaza, Tower 2 223 Hing Fong Road Kwai Chung, N.T. Hong Kong		
Gegenstand der Prüfung: Test item	Bluetooth Dongle		
Bezeichnung: Identification	C51-A05015-xx	Serien-Nr.: Serial No.	Engineering sample
Wareneingangs-Nr.: Receipt No.	050425076	Eingangsdatum: Date of receipt	25.04.05
Prüfört: Testing location	TÜV Rheinland Hong Kong Ltd. Room 8, 25th Floor, Skyline Tower, 39 Wang Kwong Road, Kowloon Bay Kowloon, Hong Kong Hong Kong Productivity Council HKPC Building, 78 Tat Chee Avenue, Kowloon, Hong Kong		
Prüfgrundlage: Test specification	FCC Part 15 Subpart C ANSI C63.4-2003 CISPR 22:1997		
Prüfergebnis: Test Result	Das vorstehend beschriebene Gerät wurde geprüft und entspricht oben genannter Prüfgrundlage. The above mentioned product was tested and passed .		
geprüft / tested by:		kontrolliert / reviewed by:	
03.06.2004	Fred Wai	23.06.2004	Thomas Berns
Datum	Name	Datum	Name
Date	Name	Date	Name
			
	Unterschrift		Unterschrift
	Signature		Signature
Sonstiges: Other Aspects	FCCID: RKI-IM412-A		
Abkürzungen:	OK, Pass, P Fail, F N/A NT	= entspricht Prüfgrundlage = entspricht nicht Prüfgrundlage = nicht anwendbar = nicht getestet	Abbreviations: OK, Pass, P Fail, F N/A NT = passed = failed = not applicable = not tested
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. This test report relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicate in extracts. This test report does not entitle to carry any safety mark on this or similar products.			

Table of Content

	Page
Cover Page	1
Table of Content	2
Product information.....	4
Manufacturers declarations	4
Product function and intended use.....	4
Submitted documents	4
Special accessories and auxiliary equipment.....	4
List of Test and Measurement Instruments.....	5
Result FCC Part 15 – Subpart C	6
Subclause 15.203 – Antenna Information.....	Pass..... 6
Subclause 15.204 – Antenna Information.....	Pass..... 6
Subclause 15.207 – Disturbance Voltage on AC Mains	Pass..... 6
Subclause 15.247 (a) – Carrier Frequency Separation.....	Pass..... 7
Subclause 15.247 (a) – Time of Occupancy (Dwell Time).....	Pass..... 8
Subclause 15.247 (a) – 20 dB Bandwidth	Pass..... 9
Subclause 15.247 (a) – Hopping Sequence	Pass..... 9
Subclause 15.247 (a) – Equal Hopping Frequency Use	Pass..... 10
Subclause 15.247 (a) – Receiver Input Bandwidth	Pass..... 11
Subclause 15.247 (a) – Receiver Hopping Capability.....	Pass..... 11
Subclause 15.247 (b) – Peak Output Power	Pass..... 11
Subclause 15.247 (b) – Band edge compliance	Pass..... 12
Subclause 15.247 (c) – Spurious Conducted Emissions	Pass..... 12
Subclause 15.247 (c) – Spurious Radiated Emissions.....	Pass..... 13
Appendix 1 – Test protocols	25 pages
Appendix 2 – Test setup	2 pages
Appendix 3 – Photo documentation	5 pages

Appendix 4 – Product documentation 18 pages

Product information

Manufacturers declarations

	Transmitter	Receiver
Operating frequency range	2402 - 2480 MHz	2402 - 2480 MHz
Type of modulation	FHSS modulation	FHSS modulation
Number of channels	79	79
Channel separation	1 MHz	1 MHz
Type of antenna	On board Chip Antenna	On board Chip Antenna
Antenna gain (dBi)	2	
Power level	fix	
Type of equipment	stand alone, plug-in radio device	stand alone, plug-in radio device
Connection to public utility power line	No	
Nominal voltage	V _{nom} : 3.9 V	V _{nom} : 3.9 V
Independent Operation Modes	Page scan Inquiry scan Connection state - ACL Link Connection state - SCO Link	

Product function and intended use

The test item is a dongle based on the Bluetooth technology. It connects with musical player (I-pod) to transfer the stereo sound quality to Bluetooth headset support the same Advanced Audio Distribution profile.

Bluetooth is a short-range radio link intended to be a cable replacement between portable and/or fixed electronic devices.

Bluetooth operates in the unlicensed ISM Band at 2.4 GHz. In the US a band of 83.5 MHz width is available. In this band, 79 RF channels spaced 1 MHz apart are defined.

The channel is represented by a pseudo-random hopping sequence through the 79 channels. The channel is divided into time slots, with a nominal slot length of 625 µs, where each slot corresponds to different RF hop frequencies. The nominal hop rate is 1600 hops/s. The symbol rate on the channel is 1 Ms/s.

Submitted documents

Circuit Diagram
Block Diagram
Bill of material
User manual

Special accessories and auxiliary equipment

The product has been tested together with the following additional accessory:

1. Manufacturer: FP
Model number: SAW04-05.00-200US
Input: 100-240VAC, 50-60Hz
Output: 5V, 200mA

List of Test and Measurement Instruments

	Kind of Equipment	Manufacturer	Type	S/N
☐	Test Receiver	Rohde & Schwarz	ESH-3	890173/033
☐	L/I/S/N	Rohde & Schwarz	ESH 3-Z5	849876/026
☐	Oscilloscope	HP	54713B	US34510455
☐	Test Receiver	Rohde & Schwarz	ESVP	882402/033
☐	Absorbing Clamp	Rohde & Schwarz	MDS-21	979 3/4
☒	Test Receiver	Rohde & Schwarz	ESVS30	842807/009
☒	Biconical Antenna	Rohde & Schwarz	HK116	841489/015
☒	Log.-Periodic Antenna	Rohde & Schwarz	HL223	841516/017
☐	Universal Power Analyzer	Voltech	PM3000A	9915
☐	Reference Impedance Network	Voltech	IEC 555 Standard	9946
☐	AC Power Source	California Instr.	4500L	HK51895
☐	Trip-Loop Antenna	Chase	LLA6142	1019
☒	Double Ridge Horn Antenna	EMCO	3115	9002-3351
☒	Double Ridge Horn Antenna	EMCO	3115	9002-3347
☐	RF Comms Test Set	HP	8920B	US36492628
☐	Spectrum Analyser + Tracking G.	HP	8596E	3639A00758
☐	Signal Generator	Rohde & Schwarz	SMY 01	844146/024
☐	Signal Generator	Rohde & Schwarz	SMY 01	844146/023
☐	BiLog Antenna	EMCO	3143	9607-1287
☐	Isotropic Field Probe	Holladay	HI-4422	90956
☐	Power Amplifier	Kalmus	757-LC	7620-1
☐	Power Amplifier	Kalmus	122-FC	7620-2
☐	Coupling Clamp	Schaffner	CDN 126	312
☐	Couple Device Network	Fischer	CDN-M2	9604
☒	Spectrum Analyzer	Rohde & Schwarz	FSP30	1093.4495K30
☐	Temperature Chamber	Binder	MK 240	9020-0028
☐	EFT,ESD,SURGE, DIPS tester	Schaffner	Best 96	IN3796-011
☐	Surge Generator	Schaffner	NSG650	280

Result FCC Part 15 – Subpart C

Subclause 15.203 – Antenna Information		Pass
Requirement:	No antenna other than that furnished by the responsible party shall be used with the device	
Result:	Permanent attached antenna	
Verdict:	Pass	

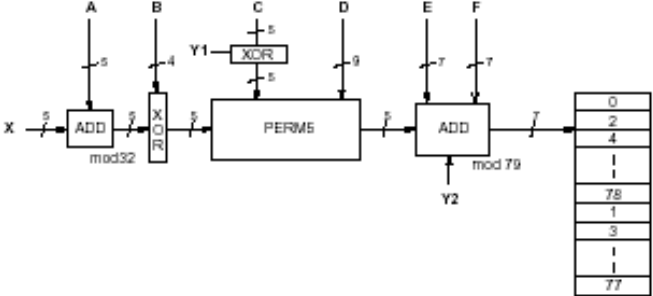
Subclause 15.204 – Antenna Information		Pass
Requirement:	Provide information for every antenna proposed for the use with the EUT	
Result:	a) Antenna type: Dielectric Chip Antenna soldered to the circuit board b) Manufacturer and model no: N.A. c) Gain with reference to an isotropic radiator: 2 dBi	
Verdict:	Pass	

Subclause 15.207 – Disturbance Voltage on AC Mains						Pass.
Test Port: AC mains input port of the charger Applied voltage: 110VAC Applicable only to equipment designed to be connected to the public utility power line. 1) Mode of operation: Charging only						
Live measurement						
Frequency range (MHz)	Frequency (MHz)	Quasi-peak dBµV	Average dBµV	Limit QP (dBµV)	Limit AV (dBµV)	Verdict
0,15 – 0,5	0.168000	45.6	32.4	66 - 56	56 - 46	Pass
0,15 – 0,5	0.678000	31.7	21.2	66 - 56	56 - 46	Pass
> 0,5 - 5	2.586000	28.1	14.1	56	46	Pass
Neutral measurement						
Frequency range (MHz)	Frequency (MHz)	Quasi-peak dBµV	Average dBµV	Limit QP (dBµV)	Limit AV (dBµV)	Verdict
0,15 – 0,5	0.168000	48.1	33.4	66 - 56	56 - 46	Pass
0,15 – 0,5	0.678000	33.6	19.1	66 - 56	56 - 46	Pass
> 0,5 - 5	2.112000	31.8	15.9	56	46	Pass
Result: The radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150kHz to 30MHz does not exceed the limits. For test results plots refer to Appendix 1, page 2-4.						

Subclause 15.247 (a) – Carrier Frequency Separation		Pass
Requirement: Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or the 20dB bandwidth of the hopping channel, whichever is greater.		
Test Specification : FCC Part 15 Subpart A – Subclause 15.31 Mode of operation : Tx mode (hopping on), DH1 packet Port of testing : Temporary antenna port Detector : Peak RBW/VBW : 100 kHz / 300 kHz Supply voltage : 12VDC from AC/DC adapter Temperature : 23°C Humidity : 50%		
Result: The centre frequencies of the hopping channels are separated by more than the 20dB bandwidth. For test results plots refer to Appendix 1, page 2.		
Verdict: Pass		

Subclause 15.247 (a) – Time of Occupancy (Dwell Time)	Pass
Requirement: Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 non-overlapping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.	
Test Specification : FCC Part 15 Subpart A – Subclause 15.31 Mode of operation : Tx mode (hopping on), DH5 packet Port of testing : Temporary antenna port Detector : Peak RBW/VBW : 1 MHz / 3 MHz Supply voltage : 12VDC from AC/DC adapter Temperature : 23°C Humidity : 50%	
Result: The screenshot in Appendix 1 page 4 shows the occurrence of a channel in a 31.6 s time period. In normal hopping mode Bluetooth is using 79 hopping channels only. The frequency was used 64 times. The dwell time for the longest supported packet type is about 3 ms. As a result the average time of occupancy will not be greater than 400 ms. i.e. Time period calculation: $0.4 \times 79 = 31.6\text{s}$ Limit calculation: $64 \times 2.928 \times 10^{-3} = 187.4 \times 10^{-3}$ $\leq 400 \times 10^{-3} \text{ s}$ For test protocols please refer to Appendix 1, page 3-4. Verdict: Pass	

Subclause 15.247 (a) – 20 dB Bandwidth		Pass.	
Requirement:	Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or the 20dB bandwidth of the hopping channel, whichever is greater.		
Test Specification : FCC Part 15 Subpart A – Subclause 15.31 Mode of operation : Tx mode (2402MHz, 2441MHz, 2480MHz), DH5 packet Port of testing : Temporary antenna port Detector : Peak RBW/VBW : 30 kHz / 100 kHz Supply voltage : 12VDC from AC/DC adapter Temperature : 23°C Humidity : 50%			
Results For test protocols refer to Appendix 1, page 5-7.			
Frequency (MHz)	20 dB left (MHz)	20 dB right (MHz)	20dB bandwidth (MHz)
2402	0.464	0.460	0.924
2441	0.464	0.464	0.928
2480	0.468	0.460	0.928

Subclause 15.247 (a) – Hopping Sequence	Pass
Requirement:	The hopping sequence is generated and provided with an example.
Hopping sequence The channel is represented by a pseudo-random hopping sequence hopping through the 79 RF channels. The hopping sequence is unique for the piconet and is determined by the Bluetooth device address of the master. The X input determines the phase in the 32-hop segment, whereas Y1 and Y2 selects between master-to-slave and slave-to-master transmission. The inputs A to D determine the ordering within the segment, the inputs E and F determine the mapping onto the hop frequencies.	
	

Example data:

Hop sequence {k} for CONNECTION STATE:

CLK start: 0x0000010

ULAP: 0x00000000

#ticks: 00 02 | 04 06 | 08 0a | 0c 0e | 10 12 | 14 16 | 18 1a | 1c 1e |

```

0x0000010: 08 66 | 10 70 | 12 19 | 14 23 | 16 01 | 18 05 | 20 33 | 22 37 |
0x0000030: 24 03 | 26 07 | 28 35 | 30 39 | 32 72 | 34 76 | 36 25 | 38 29 |
0x0000050: 40 74 | 42 78 | 44 27 | 46 31 | 48 09 | 50 13 | 52 41 | 54 45 |
0x0000070: 56 11 | 58 15 | 60 43 | 62 47 | 32 17 | 36 19 | 34 49 | 38 51 |
0x0000090: 40 21 | 44 23 | 42 53 | 46 55 | 48 33 | 52 35 | 50 65 | 54 67 |
0x00000b0: 56 37 | 60 39 | 58 69 | 62 71 | 64 25 | 68 27 | 66 57 | 70 59 |
0x00000d0: 72 29 | 76 31 | 74 61 | 78 63 | 01 41 | 05 43 | 03 73 | 07 75 |
0x00000f0: 09 45 | 13 47 | 11 77 | 15 00 | 64 49 | 66 53 | 68 02 | 70 06 |
0x0000110: 01 51 | 03 55 | 05 04 | 07 08 | 72 57 | 74 61 | 76 10 | 78 14 |
0x0000130: 09 59 | 11 63 | 13 12 | 15 16 | 17 65 | 19 69 | 21 18 | 23 22 |
0x0000150: 33 67 | 35 71 | 37 20 | 39 24 | 25 73 | 27 77 | 29 26 | 31 30 |
0x0000170: 41 75 | 43 00 | 45 28 | 47 32 | 17 02 | 21 04 | 19 34 | 23 36 |
0x0000190: 33 06 | 37 08 | 35 38 | 39 40 | 25 10 | 29 12 | 27 42 | 31 44 |
0x00001b0: 41 14 | 45 16 | 43 46 | 47 48 | 49 18 | 53 20 | 51 50 | 55 52 |
0x00001d0: 65 22 | 69 24 | 67 54 | 71 56 | 57 26 | 61 28 | 59 58 | 63 60 |
0x00001f0: 73 30 | 77 32 | 75 62 | 00 64 | 49 34 | 51 42 | 57 66 | 59 74 |
0x0000210: 53 36 | 55 44 | 61 68 | 63 76 | 65 50 | 67 58 | 73 03 | 75 11 |
0x0000230: 69 52 | 71 60 | 77 05 | 00 13 | 02 38 | 04 46 | 10 70 | 12 78 |
0x0000250: 06 40 | 08 48 | 14 72 | 16 01 | 18 54 | 20 62 | 26 07 | 28 15 |
0x0000270: 22 56 | 24 64 | 30 09 | 32 17 | 02 66 | 06 74 | 10 19 | 14 27 |
0x0000290: 04 70 | 08 78 | 12 23 | 16 31 | 18 03 | 22 11 | 26 35 | 30 43 |
0x00002b0: 20 07 | 24 15 | 28 39 | 32 47 | 34 68 | 38 76 | 42 21 | 46 29 |
0x00002d0: 36 72 | 40 01 | 44 25 | 48 33 | 50 05 | 54 13 | 58 37 | 62 45 |
0x00002f0: 52 09 | 56 17 | 60 41 | 64 49 | 34 19 | 36 35 | 50 51 | 52 67 |
0x0000310: 38 21 | 40 37 | 54 53 | 56 69 | 42 27 | 44 43 | 58 59 | 60 75 |
0x0000330: 46 29 | 48 45 | 62 61 | 64 77 | 66 23 | 68 39 | 03 55 | 05 71 |
0x0000350: 70 25 | 72 41 | 07 57 | 09 73 | 74 31 | 76 47 | 11 63 | 13 00 |
0x0000370: 78 33 | 01 49 | 15 65 | 17 02 | 66 51 | 70 67 | 03 04 | 07 20 |
0x0000390: 68 55 | 72 71 | 05 08 | 09 24 | 74 59 | 78 75 | 11 12 | 15 28 |
0x00003b0: 76 63 | 01 00 | 13 16 | 17 32 | 19 53 | 23 69 | 35 06 | 39 22 |
0x00003d0: 21 57 | 25 73 | 37 10 | 41 26 | 27 61 | 31 77 | 43 14 | 47 30 |
0x00003f0: 29 65 | 33 02 | 45 18 | 49 34 | 19 04 | 21 08 | 23 20 | 25 24 |

```

Subclause 15.247 (a) – Equal Hopping Frequency Use**Pass**

Requirement: Each of the transmitter's hopping channels is used equally on average.

Equal hopping frequency use

The EUT complies with the Bluetooth RF specifications. For details refer to the Bluetooth standard.

Subclause 15.247 (a) – Receiver Input Bandwidth		Pass
Requirement:	The associated receiver(s) complies with the requirement that its input bandwidth matches the bandwidth of the transmitted signal.	
Receiver input bandwidth		
The receiver bandwidth is equal to the receiver bandwidth in the 79 hopping channel mode, which is 1 MHz. The receiver bandwidth was verified during Bluetooth RF conformance testing.		

Subclause 15.247 (a) – Receiver Hopping Capability		Pass
Requirement:	The associated receiver has the ability to shift frequencies in synchronisation with the transmitted signals.	
Receiver hopping Capability		
The EUT complies with the Bluetooth RF specifications. For details refer to the Bluetooth standard.		

Subclause 15.247 (b) – Peak Output Power		Pass			
Test Specification : FCC Part 15 Subpart A – Subclause 15.31 Mode of operation : Tx mode (2402MHz, 2441MHz, 2480MHz), DH1 packet Port of testing : Temporary antenna port Detector : Peak RBW/VBW : 1 MHz / 3 MHz Supply voltage : 12VDC from AC/DC adapter Temperature : 23°C Humidity : 50%					
Requirement:	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 5725-5850 MHz band: 1 Watt. For all other frequency hopping systems in the 2400 – 2483.5 MHz band: 0.125 Watts.				
Result All three transmit frequency modes comply with the maximum peak output power limit. For test protocols please refer to Appendix 1, page 8-10.					
Frequency (MHz)	Maximum peak output power (dBm)	Cable attenuation (dB)	Output power (dBm)	Limit (W/dBm)	Verdict
2402	1.90	3.52	5.42	1 / 30.0	Pass
2441	1.58	3.65	5.23	1 / 30.0	Pass
2480	0.88	3.60	4.48	1 / 30.0	Pass

Subclause 15.247 (b) – Band edge compliance		Pass
Test Specification : FCC Part 15 Subpart A – Subclause 15.31 Mode of operation : Tx mode (2402MHz, 2441MHz, 2480MHz), DH1 packet Port of testing : Temporary antenna port Detector : Peak RBW/VBW : 300 kHz / 1 MHz Supply voltage : 12VDC from AC/DC adapter Temperature : 23°C Humidity : 50%		
Requirement: 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.		
Result There is no peak found outside any 100 kHz bandwidth of the operating frequency band in the three transmit frequency. All three transmit frequency modes comply with the limit stated in subclause 15.247(c). For test protocols refer to Appendix 1, page 11-13.		

Subclause 15.247 (c) – Spurious Conducted Emissions					Pass
Test Specification : FCC Part 15 Subpart A – Subclause 15.31 Mode of operation : Tx mode (2402MHz, 2441MHz, 2480MHz), DH1 packet Port of testing : Temporary antenna port Detector : Peak RBW/VBW : 100 kHz / 300 kHz Supply voltage : 12VDC from AC/DC adapter Temperature : 23 °C Humidity : 50 %					
Requirement: 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.					
Result There is no peak found outside any 100kHz bandwidth of the operating frequency band in the three transmit frequency. All three transmit frequency modes comply with the limit stated in subclause 15.247(c). For test protocols refer to Appendix 1, page 14-20.					
Operating frequency (MHz)	Spurious frequency (MHz)	Spurious Level (dBm)	Reference value (dBm)	Delta (dB)	Verdict
2402	4795.66	-42.87	1.89	44.76	Pass
2441	4875.42	-41.43	1.88	43.31	Pass
2480	4955.18	-38.68	0.60	39.28	Pass

Subclause 15.247 (c) – Spurious Radiated Emissions							Pass
Test Specification : ANSI C63.4 - 2003 Mode of operation : Tx mode (2402MHz, 2441MHz, 2480MHz), DH1 packet Port of testing : Enclosure Detector : Peak RBW/VBW : 100 kHz / 300 kHz for $f < 1$ GHz 1 MHz / 3 MHz for $f > 1$ GHz Supply voltage : 12VDC from car battery Temperature : 23°C Humidity : 50%							
Requirement: 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.							
Result All three transmit frequency modes comply with the field strength within the restricted bands. For test protocols refer to Appendix 1, page 21-68.							
Tx frequency 2402MHz				Vertical Polarization			
Freq MHz	Reading dBuV	AF dB(1/m)	Cable att. dB	Pre-amp dB	Filter att. dB	Level dBuV/m	Limit/ Detector dBuV/m
200.00	21.3	10.20	1.10	-	-	32.60	43.5 / QP
228.32	19.9	10.60	1.10	-	-	31.60	43.5 / QP
267.62	23.3	11.50	1.10	-	-	35.90	43.5 / QP
4804.10	50.15	33.40	3.53	32.87	0.33	54.54	74.0 / P
4804.10	45.58	33.40	3.53	32.87	0.33	49.97	54.0 / A
Tx frequency 2402MHz				Horizontal Polarization			
Freq MHz	Reading dBuV	AF dB(1/m)	Cable att. dB	Pre-amp dB	Filter att. dB	Level dBuV/m	Limit/ Detector dBuV/m
231.84	25.2	10.60	1.10	-	-	36.90	43.5 / QP
266.30	26.0	11.50	1.10	-	-	38.60	43.5 / QP
1602.00	35.30	25.40	1.89	36.17	0.60	27.02	74.0 / P
1602.00	31.68	25.40	1.89	36.17	0.60	24.40	54.0 / A

Tx frequency 2441MHz Vertical Polarization							
Freq MHz	Reading dBuV	AF dB(1/m)	Cable att. dB	Pre-amp dB	Filter att. dB	Level dBuV/m	Limit/ Detector dBuV/m
227.18	19.4	10.60	1.10	-	-	31.10	43.5 / QP
266.42	23.0	11.50	1.10	-	-	35.60	43.5 / QP
4882.02	47.92	32.40	3.34	33.18	0.36	50.84	74.0 / P
4882.02	43.12	32.40	3.34	33.18	0.36	46.04	54.0 / A
Tx frequency 2441MHz Horizontal Polarization							
Freq MHz	Reading dBuV	AF dB(1/m)	Cable att. dB	Pre-amp dB	Filter att. dB	Level dBuV/m	Limit/ Detector dBuV/m
228.26	22.8	10.60	1.10	-	-	34.50	43.5 / QP
268.70	25.1	11.50	1.10	-	-	37.7	43.5 / QP
1165.20	29.45	24.40	1.52	37.10	1.87	20.14	74.0 / P
1165.12	24.56	24.40	1.52	37.10	1.87	15.25	54.0 / A
4882.00	47.03	33.40	3.53	32.87	0.33	51.42	74.0 / P
4882.00	43.43	33.40	3.53	32.87	0.33	47.82	54.0 / A
Tx frequency 2480MHz Vertical Polarization							
Freq MHz	Reading dBuV	AF dB(1/m)	Cable att. dB	Pre-amp dB	Filter att. dB	Level dBuV/m	Limit/ Detector dBuV/m
223.56	21.1	10.60	1.10	-	-	32.80	43.5 / QP
267.68	22.4	11.50	1.10	-	-	35.00	43.5 / QP
Tx frequency 2480MHz Horizontal Polarization							
Freq MHz	Reading dBuV	AF dB(1/m)	Cable att. dB	Pre-amp dB	Filter att. dB	Level dBuV/m	Limit/ Detector dBuV/m
225.92	22.2	10.60	1.10	-	-	33.90	43.5 / QP
269.80	23.1	11.50	1.10	-	-	35.70	43.5 / QP
4960.04	48.34	33.40	3.53	32.87	0.33	52.73	74.0 / P
4960.08	46.53	33.40	3.53	32.87	0.33	50.92	54.0 / A

Appendix 1

Test results

Disturbance Voltage on AC Mains

Date: 17 Jun 2005
EUT: C51-A05015-xx
Company: i.Tech Dynamics
Humidity: 50%
Temperature: 23°C
Voltage supply: 3.9VDC from Power Supply
Test by: Sharon Li
Op. mode: Charging

Live measurement

Frequency (MHz)	QP reading (dB μ V)	Av reading (dB μ V)	Results
0.168000	45.6	32.4	Pass
0.678000	31.7	21.2	Pass
2.586000	28.1	14.1	Pass

Neutral measurement

Frequency (MHz)	QP reading (dB μ V)	Av reading (dB μ V)	Results
0.168000	48.1	33.4	Pass
0.678000	33.6	19.1	Pass
2.112000	31.8	15.9	Pass

Carrier Frequency Separation

Date: 17 Jun 2005
 EUT: C51-A05015-xx
 Company: i.Tech Dynamics
 Humidity: 50%
 Temperature: 23°C
 Voltage supply: 3.9VDC from Power Supply
 Test by: Sharon Li
 Op. mode: Hopping on

Reference frequency (MHz)	Channel Separation (MHz)
2441.000	0.990

**DELTA MARKER 3**

1.032 MHz

Ref 20 dBm

*Att 30 dB

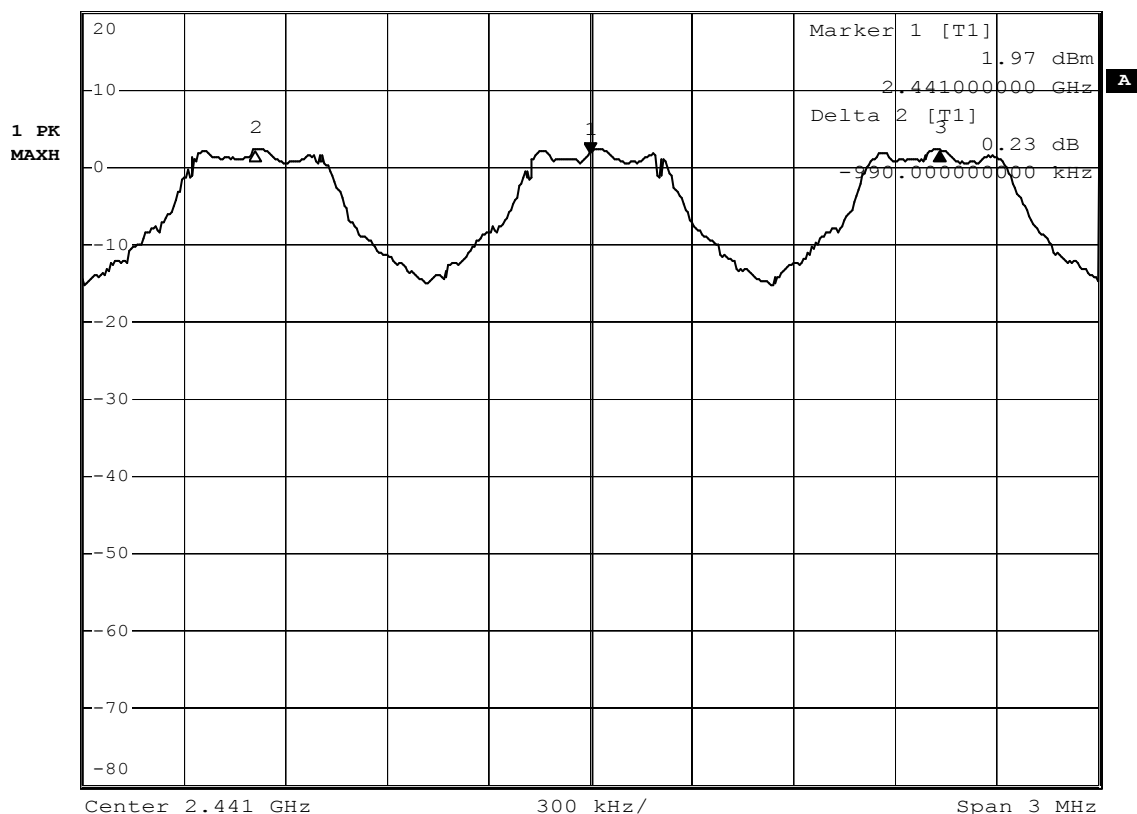
*RBW 100 kHz Delta 3 [T1]

*VBW 300 kHz

0.19 dB

*SWT 2.5 ms

1.032000000 MHz



Date: 2.JUN.2005 19:28:25

Dwell Time

Date: 17 Jun 2005
EUT: C51-A05015-xx
Company: i.Tech Dynamics
Humidity: 50%
Temperature: 23°C
Voltage supply: 3.9VDC from Power Supply
Test by: Sharon Li
Op. mode: Hopping on

Burst Duration (ms)	Number of hopping	Time of occupancy (s)	Results
2.928	64	$0.002928 \times 64 =$ 0.1874	Pass



DELTA MARKER 2

2.928 ms

Ref 20 dBm

*Att 30 dB

RBW 1 MHz

Delta 2 [T1]

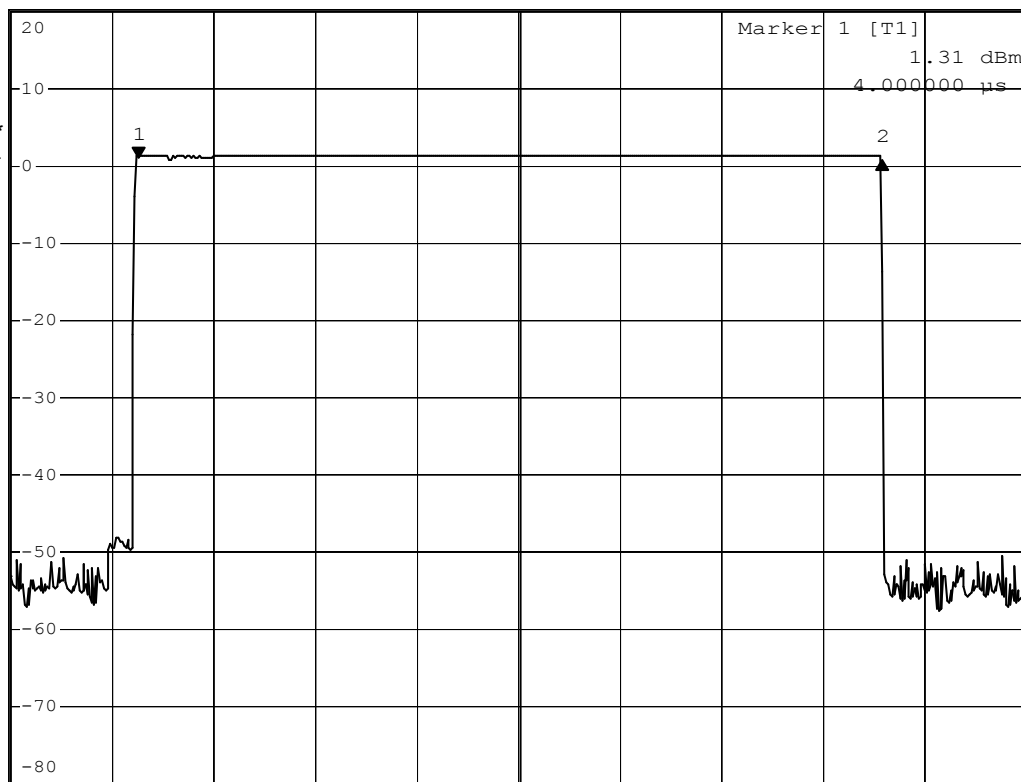
*VBW 3 MHz

-0.42 dB

SWT 4 ms

2.928000 ms

1 PK *
CLRWR



Center 2.441 GHz

400 μs/

Marker 1 [T1]

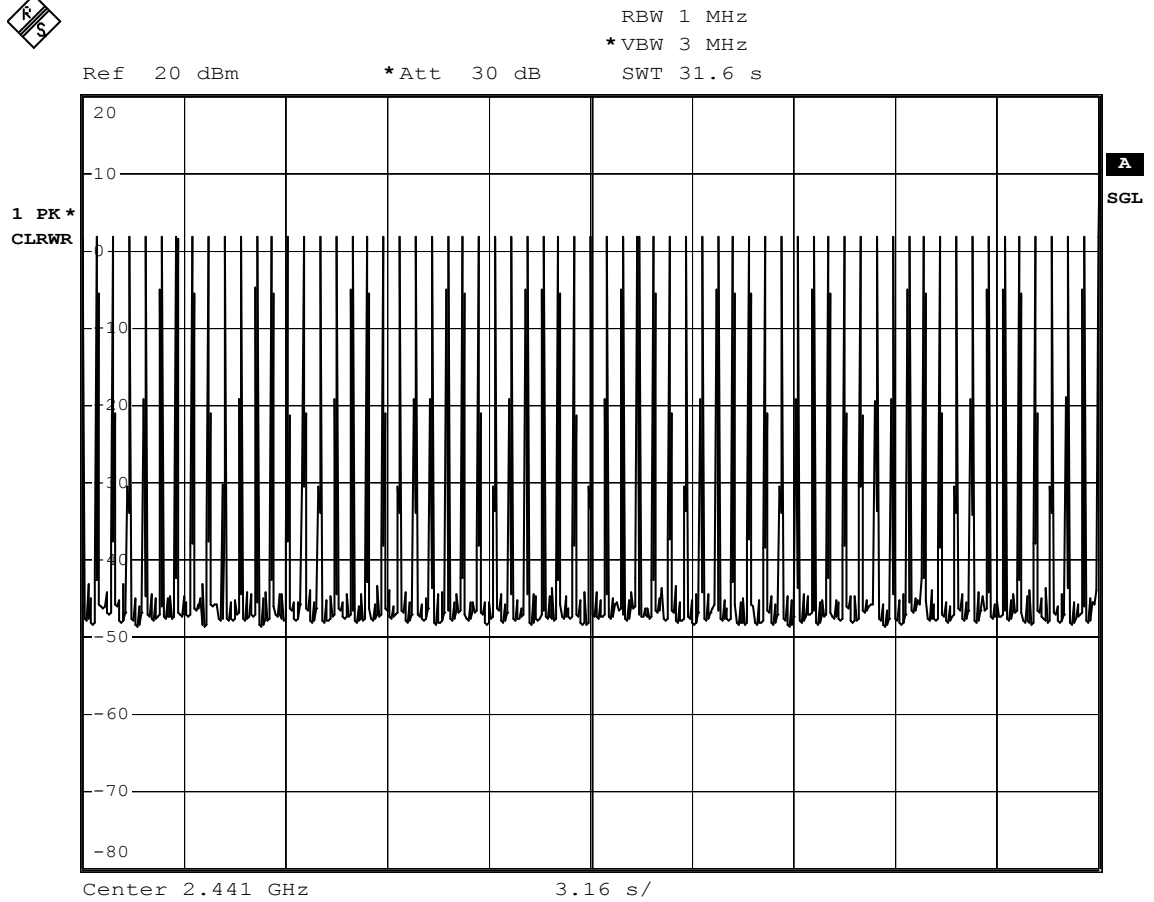
1.31 dBm

4.000000 μs

A

TRG

Date: 3.JUN.2005 10:44:51



Date: 3.JUN.2005 10:46:56

20dB Bandwidth

Date: 17 Jun 2005
 EUT: C51-A05015-xx
 Company: i.Tech Dynamics
 Humidity: 50%
 Temperature: 23°C
 Voltage supply: 3.9VDC from Power Supply
 Test by: Sharon Li
 Op. mode: TX mode, DH5 with PRBS9 payload

Tx frequency (MHz)	Δf_L (MHz)	Δf_H (MHz)	$ \Delta f_H + \Delta f_L $ (MHz)	Results
2402	0.464	0.460	0.924	Pass
2441	0.464	0.464	0.928	Pass
2480	0.468	0.460	0.928	Pass


THRESHOLD LINE

-16.97 dBm

Ref 20 dBm

*Att 30 dB

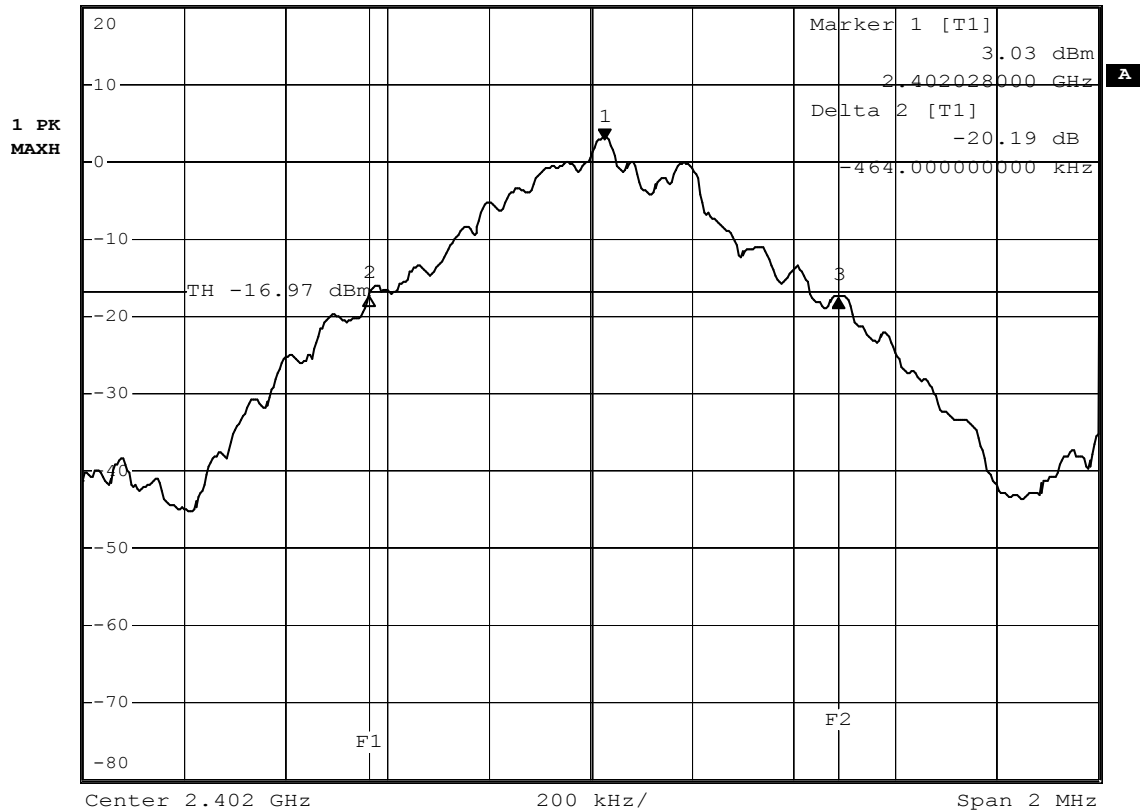
*RBW 30 kHz Delta 3 [T1]

VBW 100 kHz

-20.40 dB

SWT 2.5 ms

460.000000000 kHz



Date: 3.JUN.2005 12:54:33

Tx frequency: 2402MHz

**FREQUENCY LINE 2**

2.441492 GHz

*RBW 30 kHz Delta 3 [T1]

VBW 100 kHz

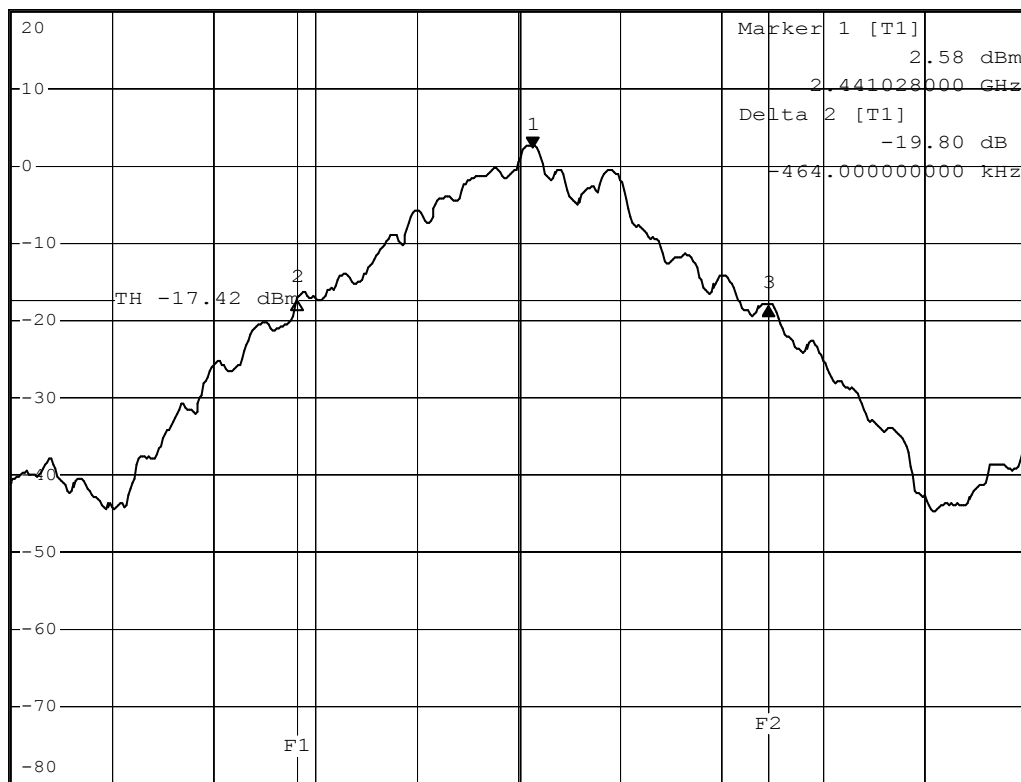
-20.50 dB

Ref 20 dBm

*Att 30 dB

SWT 2.5 ms

464.00000000 kHz

1 PK
MAXH

Center 2.441 GHz

200 kHz/

Span 2 MHz

Date: 3.JUN.2005 13:04:42

Tx frequency: 2441MHz

**FREQUENCY LINE 2**

2.480492 GHz

*RBW 30 kHz Delta 3 [T1]

VBW 100 kHz

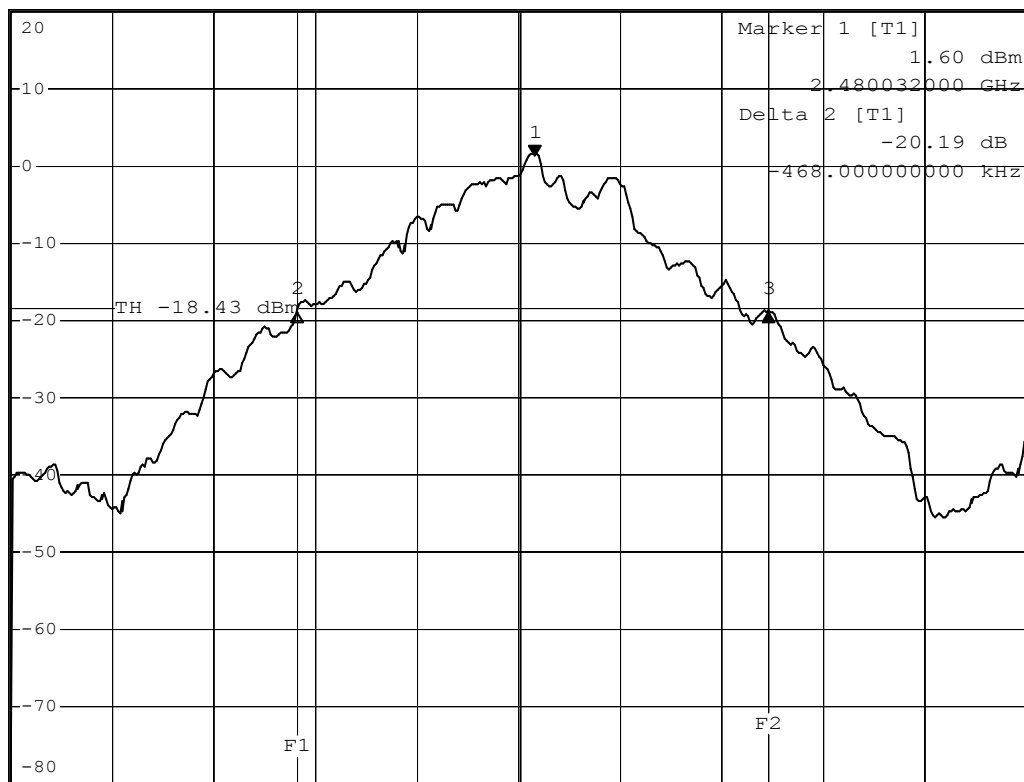
-20.39 dB

Ref 20 dBm

*Att 30 dB

SWT 2.5 ms

460.00000000 kHz

1 PK
MAXH

Center 2.48 GHz

200 kHz/

Span 2 MHz

Date: 3.JUN.2005 13:08:46

Tx frequency: 2480MHz

Peak Output Power

Date: 17 Jun 2005
 EUT: C51-A05015-xx
 Company: i.Tech Dynamics
 Humidity: 50%
 Temperature: 23°C
 Voltage supply: 3.9VDC from Power Supply
 Test by: Sharon Li
 Op. mode: TX mode, DH1 with PRBS9 payload

Tx Frequency (MHz)	Power P _{PK} (dBm)	Cable Attenuation (dB)	Actual Peak Power (dBm)	Results
2402	1.90	3.52	5.42	Pass
2441	1.58	3.65	5.23	Pass
2480	0.88	3.60	4.48	Pass

**MARKER 1**

2.40183 GHz

Ref 20 dBm

*Att 30 dB

*RBW 1 MHz

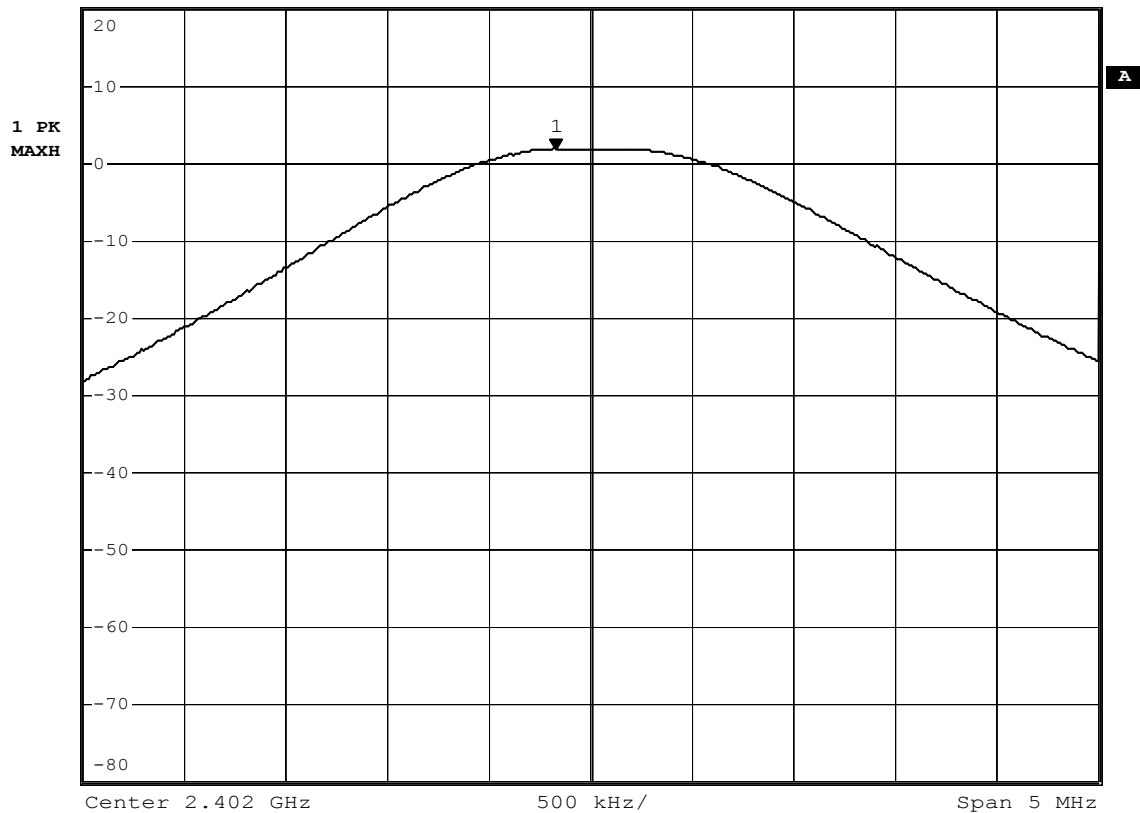
Marker 1 [T1]

*VBW 3 MHz

1.90 dBm

SWT 2.5 ms

2.401830000 GHz



Date: 3.JUN.2005 10:55:42

Tx frequency: 2402MHz



MARKER 1

2.44086 GHz

Ref 20 dBm

*Att 30 dB

*RBW 1 MHz

Marker 1 [T1]

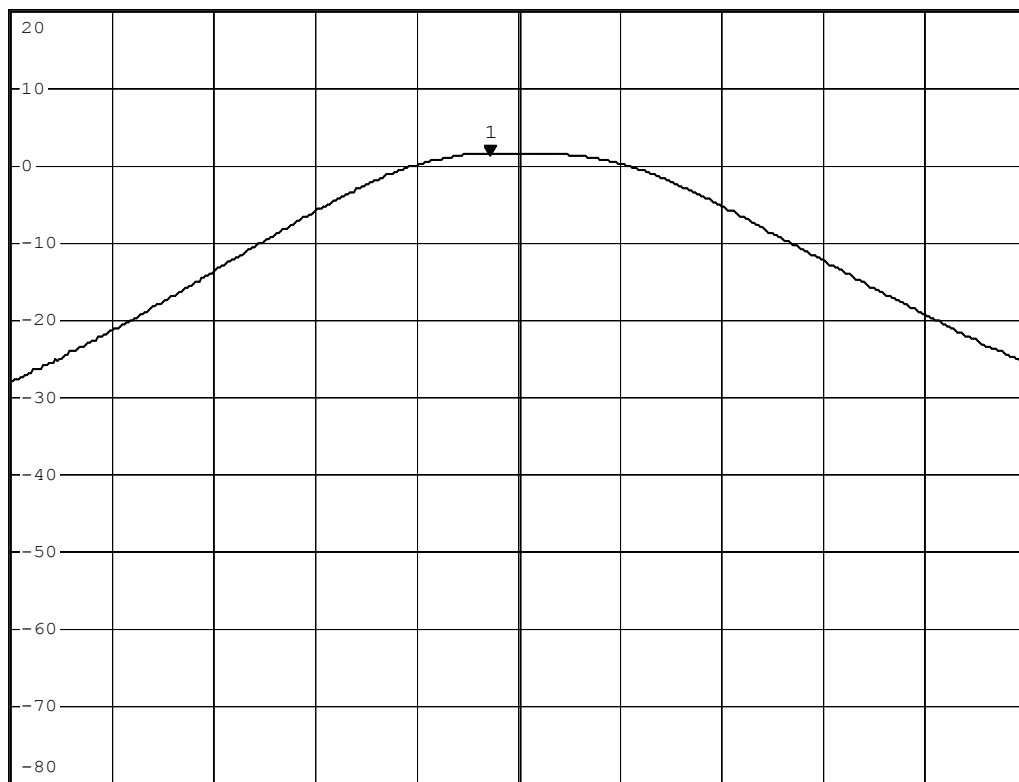
*VBW 3 MHz

1.58 dBm

SWT 2.5 ms

2.440860000 GHz

1 PK
MAXH



Center 2.441 GHz

500 kHz/

Span 5 MHz

Date: 3.JUN.2005 10:56:45

Tx frequency: 2441MHz



MARKER 1

2.47983 GHz

Ref 20 dBm

*Att 30 dB

*RBW 1 MHz

Marker 1 [T1]

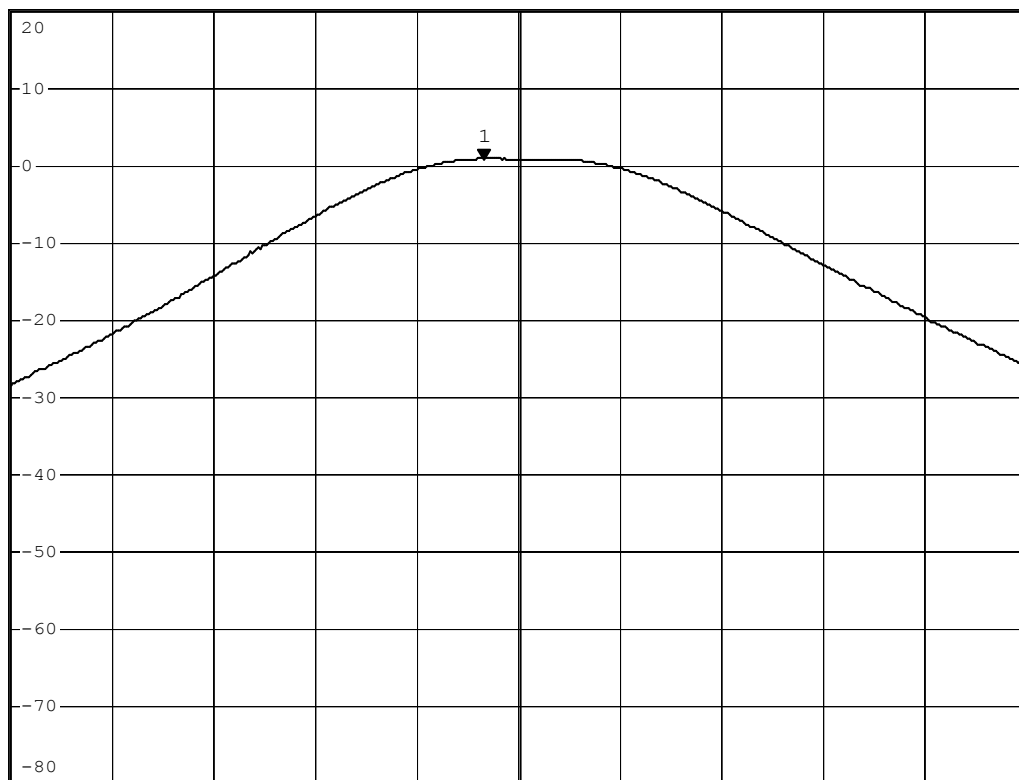
*VBW 3 MHz

0.88 dBm

SWT 2.5 ms

2.479830000 GHz

1 PK
MAXH



A

Date: 3.JUN.2005 10:57:36

Tx frequency: 2480MHz

Band Edge Compliance

Date: 17 Jun 2005
 EUT: C51-A05015-xx
 Company: i.Tech Dynamics
 Humidity: 50%
 Temperature: 23°C
 Voltage supply: 3.9VDC from Power Supply
 Test by: Sharon Li
 Op. mode: TX mode, DH1 with PRBS9 payload

Tx Frequency (MHz)	Peak in band Power level (dBm)	RF power outside 100kHz BW (MHz)	RF power difference outside 100kHz BW (dB)	Results
2402	-38.56	No Peak	-	Pass
2480	-44.93	No Peak	-	Pass

**MARKER 3**

2.38608 GHz

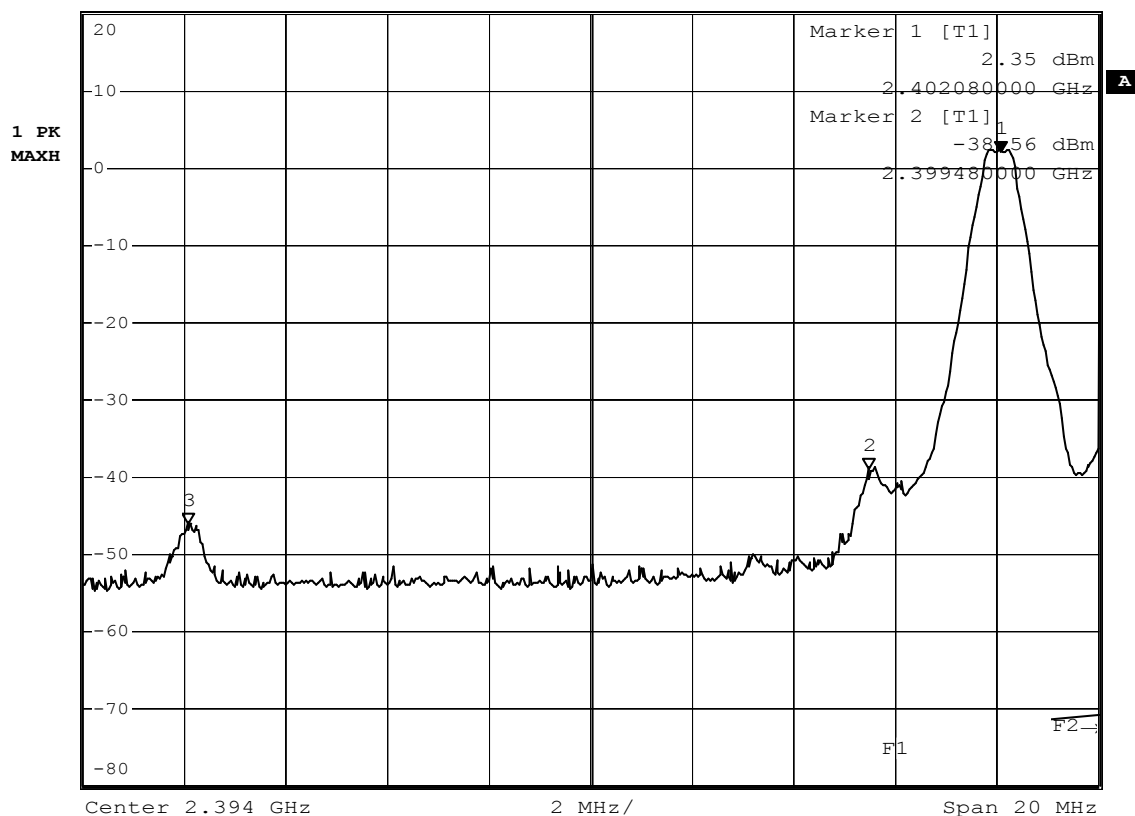
Ref 20 dBm

*Att 30 dB

*RBW 300 kHz Marker 3 [T1]

*VBW 1 MHz -45.79 dBm

*SWT 2.5 ms 2.386080000 GHz



Date: 3.JUN.2005 11:01:00

Tx frequency: 2402MHz

**MARKER 3**

2.48452 GHz

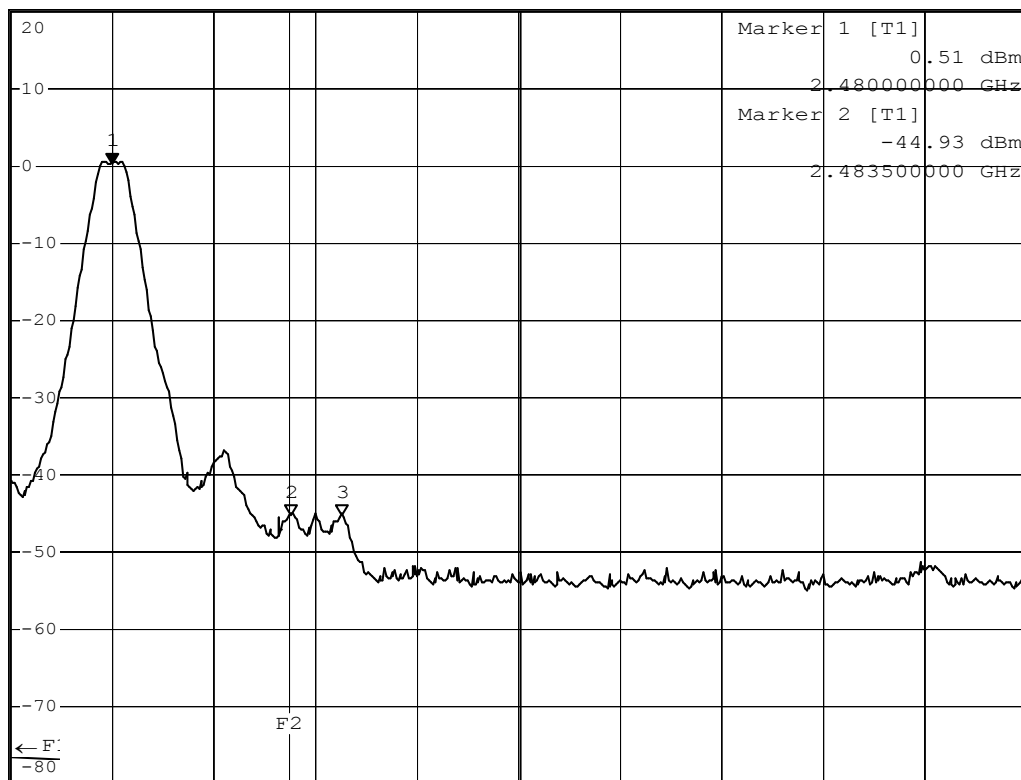
Ref 20 dBm

*Att 30 dB

*RBW 300 kHz Marker 3 [T1]

*VBW 1 MHz -44.96 dBm

*SWT 2.5 ms 2.484520000 GHz

1 PK
MAXH

Center 2.488 GHz

2 MHz/

Span 20 MHz

Date: 3.JUN.2005 11:13:08

Tx frequency: 2480MHz

Spurious Emissions - Conducted

Date: 17 Jun 2005
EUT: C51-A05015-xx
Company: i.Tech Dynamics
Humidity: 50%
Temperature: 23°C
Voltage supply: 3.9VDC from Power Supply
Test by: Sharon Li
Op. mode: TX mode, DH1 with PRBS9 payload

Tx frequency : 2402MHz

Spurious Frequency (MHz)	Power level (dBm)	Reference value (dBm)	Delta to reference level (dB)	Results
4795.66	-42.87	1.89	44.76	Pass

Tx frequency : 2441MHz

Spurious Frequency (MHz)	Power level (dBm)	Reference value (dBm)	Delta to reference level (dB)	Results
4875.42	-41.43	1.88	43.31	Pass

Tx frequency : 2480MHz

Spurious Frequency (MHz)	Power level (dBm)	Reference value (dBm)	Delta to reference level (dB)	Results
4955.18	-38.68	0.60	39.28	Pass

**MARKER 2**

4.79566 GHz

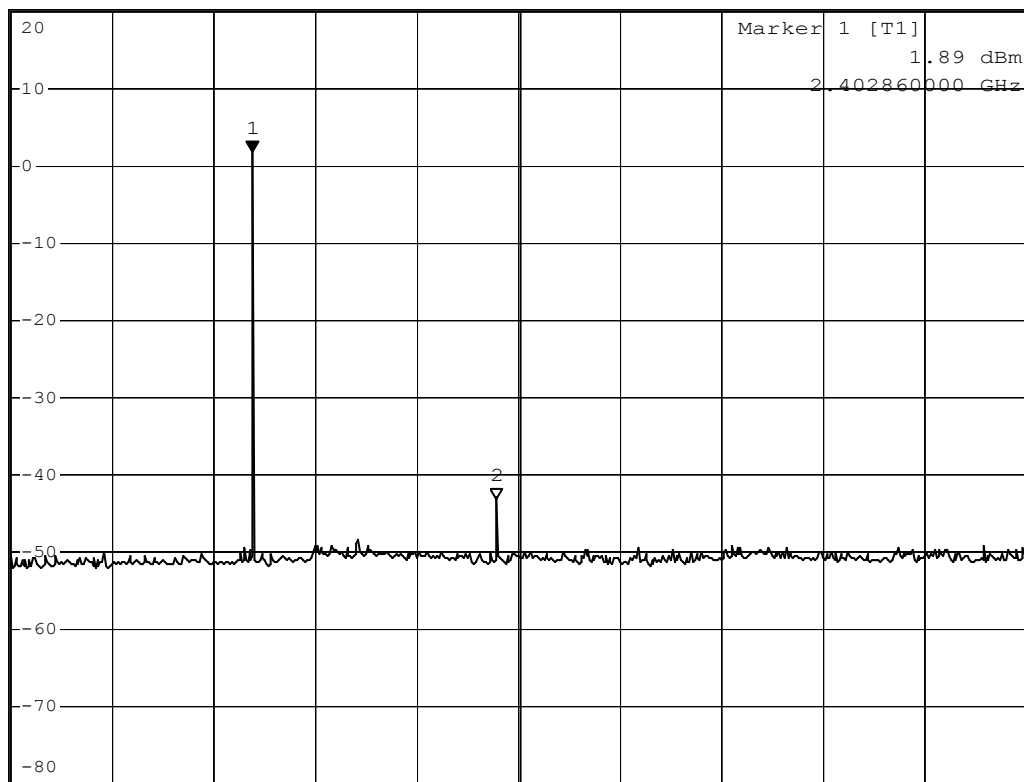
Ref 20 dBm

*Att 30 dB

*RBW 100 kHz Marker 2 [T1]

*VBW 300 kHz -42.87 dBm

*SWT 60 s 4.795660000 GHz

1 PK
MAXH

Start 30 MHz

997 MHz/

Stop 10 GHz

Date: 3.JUN.2005 11:21:36

Tx frequency: 2402MHz



MARKER 1

15.2 GHz

Ref 20 dBm

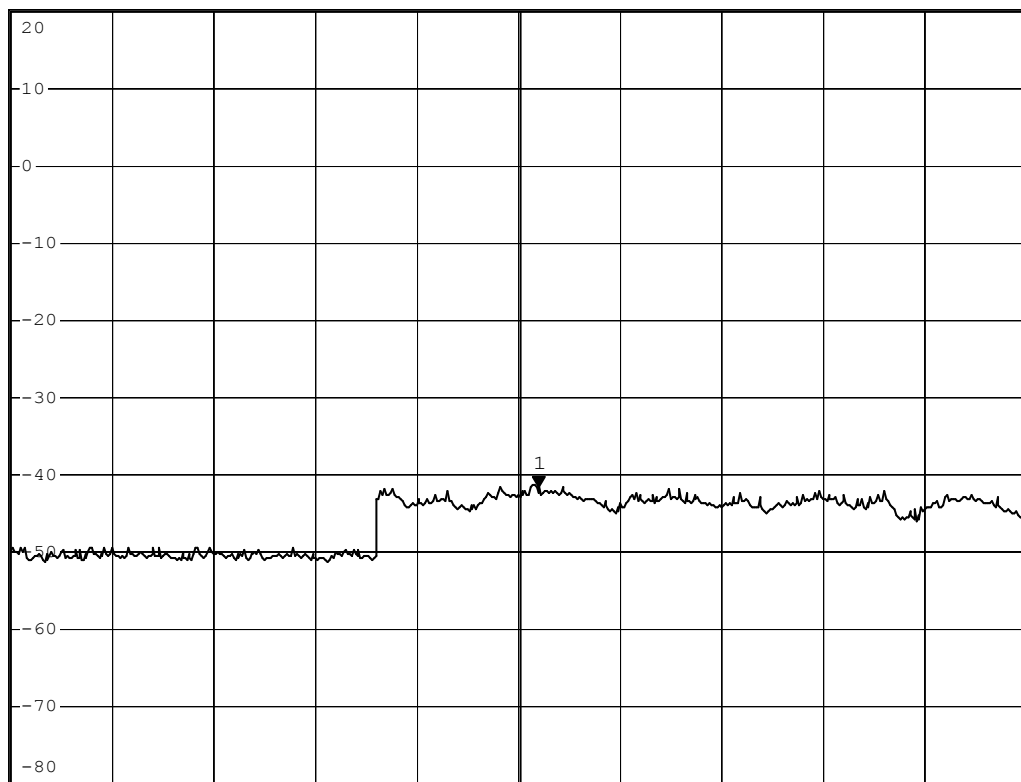
*Att 30 dB

*RBW 100 kHz Marker 1 [T1]

*VBW 300 kHz -41.17 dBm

*SWT 60 s 15.200000000 GHz

1 PK
MAXH



Start 10 GHz

1 GHz/

Stop 20 GHz

Date: 3.JUN.2005 11:26:20

Tx frequency: 2402MHz



MARKER 1

22.63 GHz

Ref 20 dBm

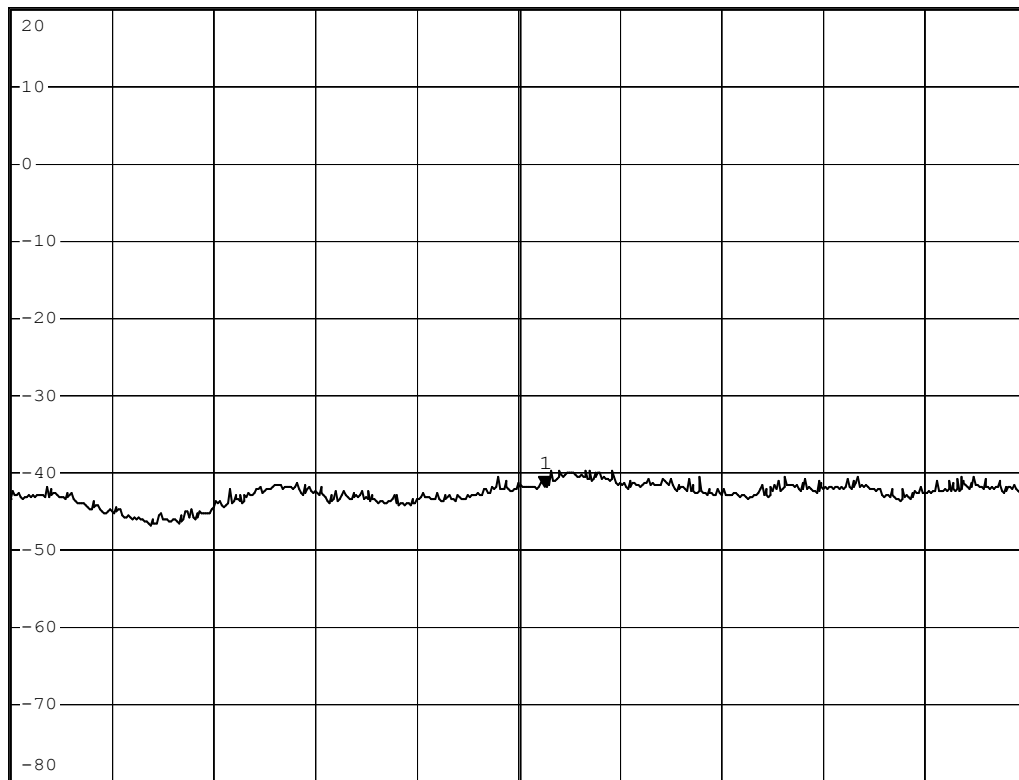
*Att 30 dB

*RBW 100 kHz Marker 1 [T1]

*VBW 300 kHz -41.56 dBm

*SWT 60 s 22.63000000 GHz

1 PK
MAXH



Start 20 GHz

500 MHz/

Stop 25 GHz

Date: 3.JUN.2005 11:29:12

Tx frequency: 2402MHz

**MARKER 2**

4.87542 GHz

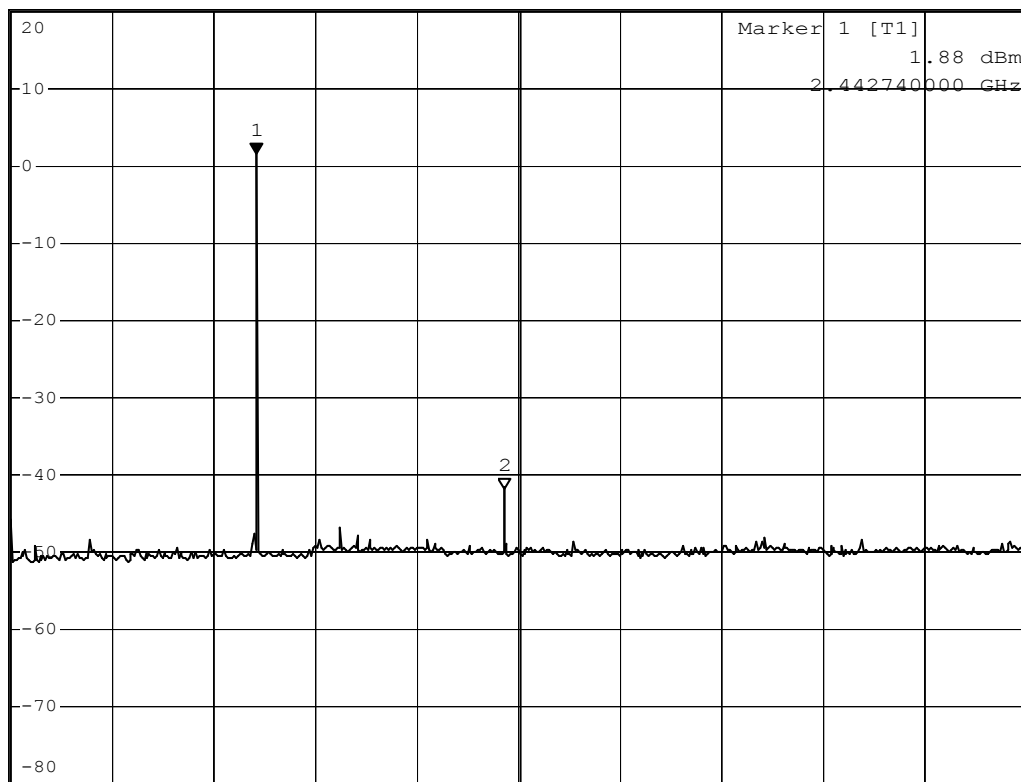
Ref 20 dBm

*Att 30 dB

*RBW 100 kHz Marker 2 [T1]

*VBW 300 kHz -41.43 dBm

*SWT 60 s 4.875420000 GHz

1 PK
MAXH

Start 30 MHz

997 MHz/

Stop 10 GHz

Date: 3.JUN.2005 12:39:14

Tx frequency: 2441MHz



MARKER 1

15.16 GHz

Ref 20 dBm

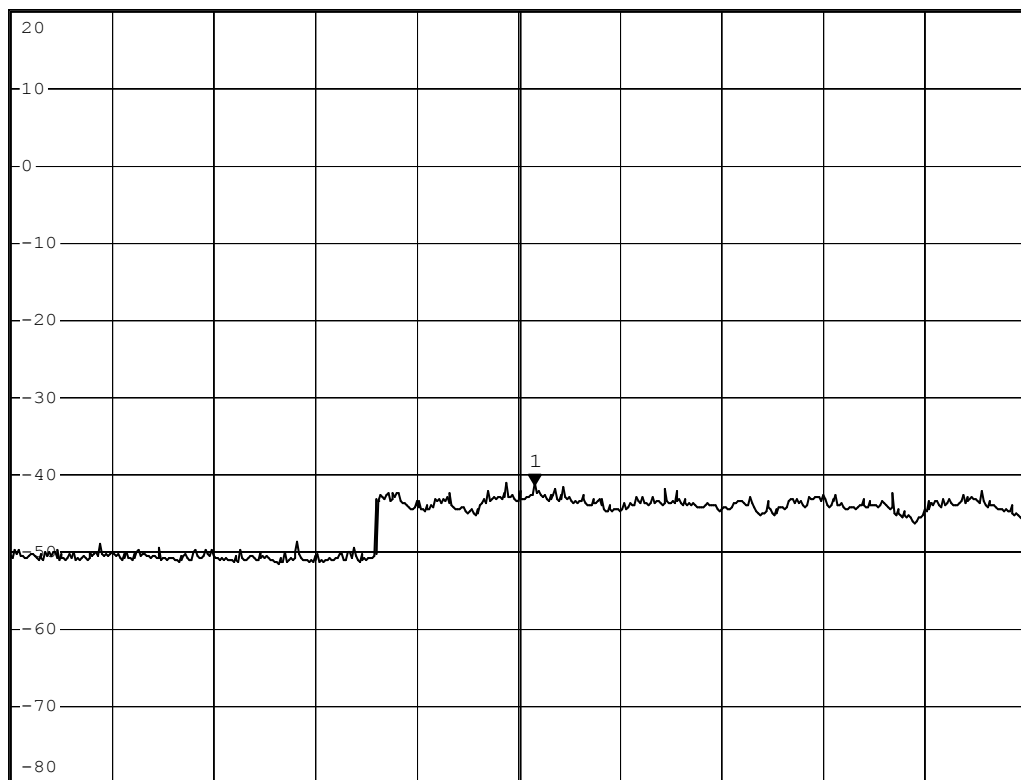
*Att 30 dB

*RBW 100 kHz Marker 1 [T1]

*VBW 300 kHz -40.96 dBm

*SWT 60 s 15.16000000 GHz

1 PK
MAXH

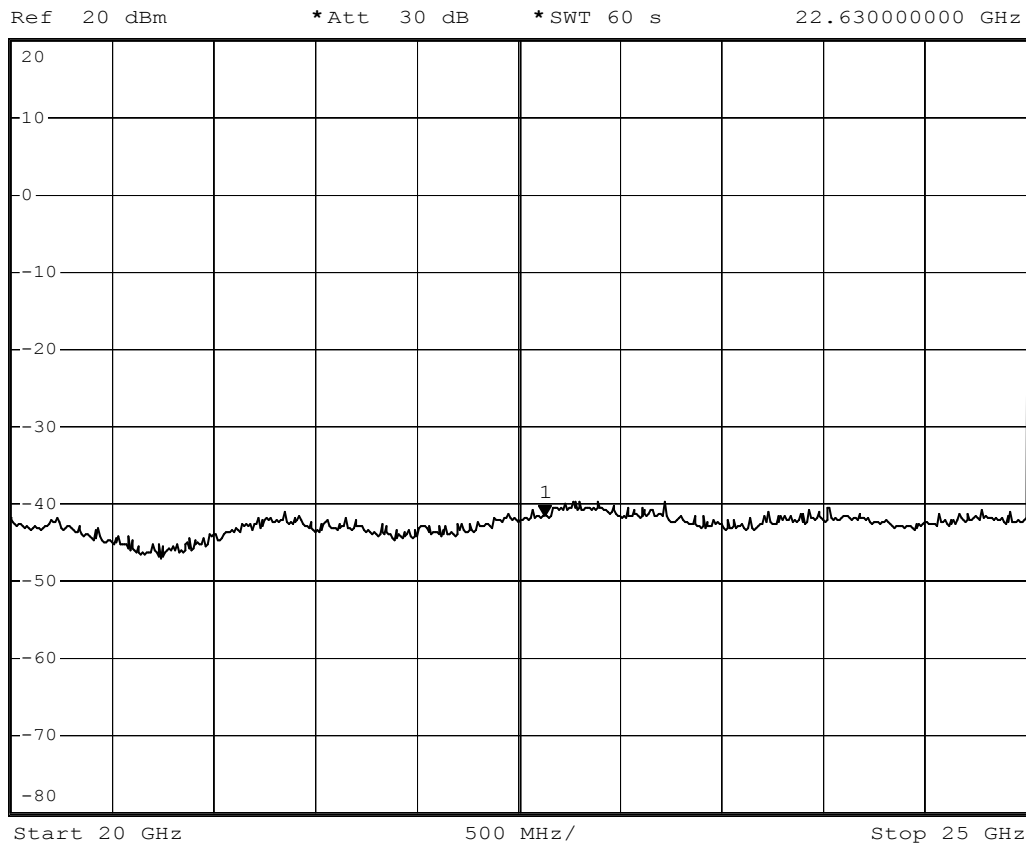


Date: 3.JUN.2005 11:57:14

Tx frequency: 2441MHz



*RBW 100 kHz Marker 1 [T1]
 *VBW 300 kHz -41.32 dBm
 *SWT 60 s 22.630000000 GHz



Date: 3.JUN.2005 11:53:06

Tx frequency: 2441MHz

**MARKER 2**

4.95518 GHz

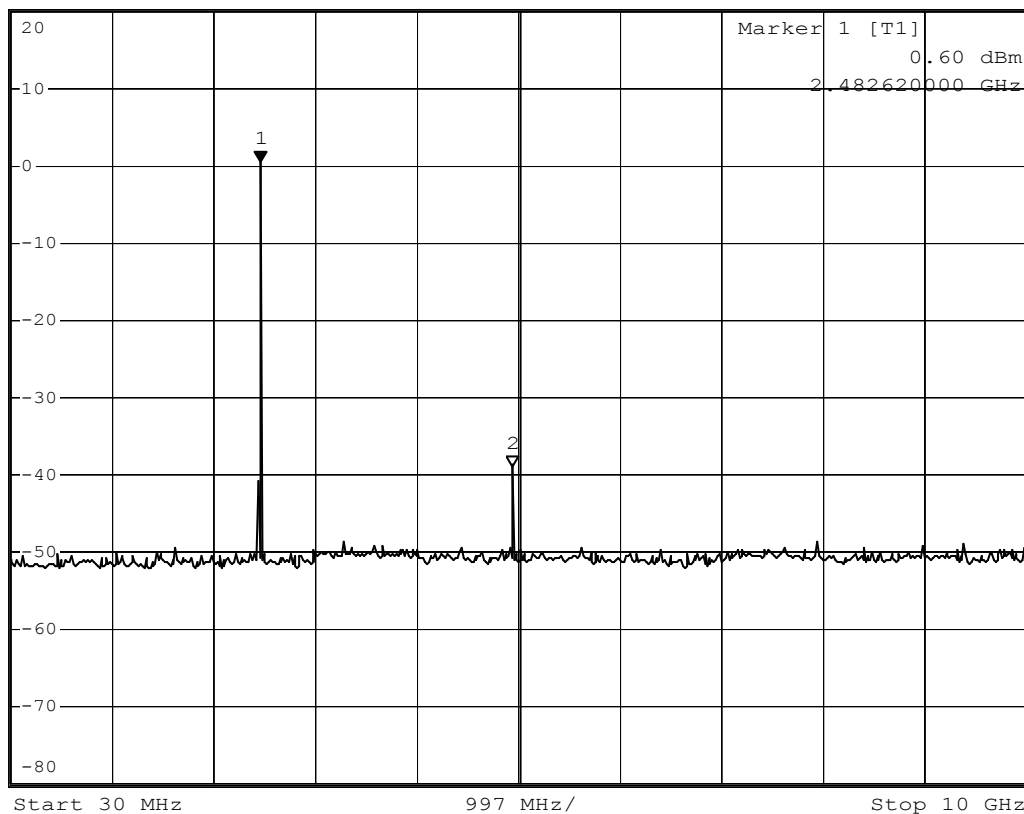
Ref 20 dBm

*Att 30 dB

*RBW 100 kHz Marker 2 [T1]

*VBW 300 kHz -38.68 dBm

*SWT 60 s 4.955180000 GHz

1 PK
MAXH

Date: 3.JUN.2005 12:43:50

Tx frequency: 2480MHz



MARKER 1

15.74 GHz

Ref 20 dBm

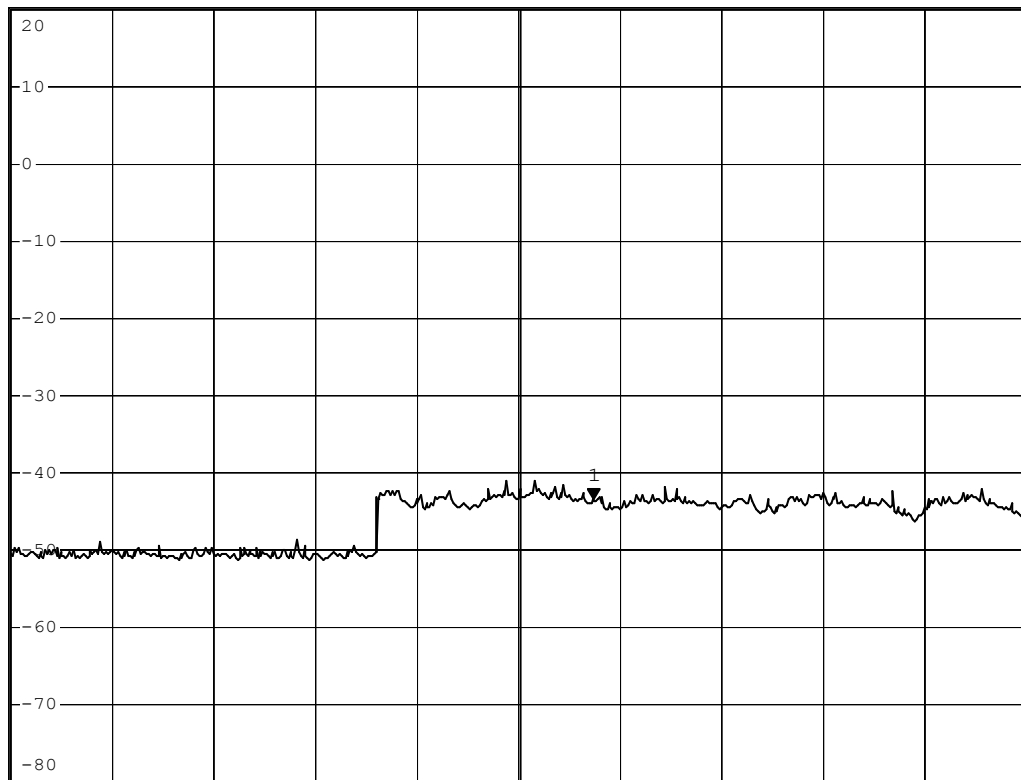
*Att 30 dB

*RBW 100 kHz Marker 1 [T1]

*VBW 300 kHz -43.22 dBm

*SWT 60 s 15.74000000 GHz

1 PK
MAXH



Start 10 GHz

1 GHz/

Stop 20 GHz

Date: 3.JUN.2005 11:57:30

Tx frequency: 2480MHz



MARKER 1

23.18 GHz

Ref 20 dBm

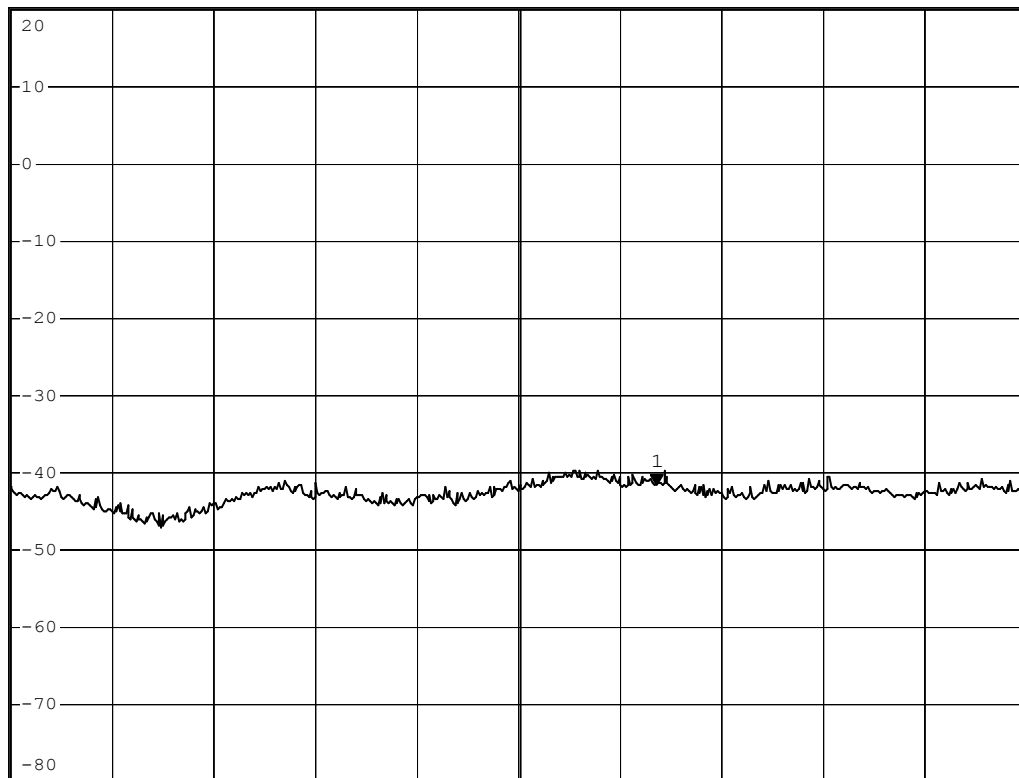
*Att 30 dB

*RBW 100 kHz Marker 1 [T1]

*VBW 300 kHz -41.33 dBm

*SWT 60 s 23.18000000 GHz

1 PK
MAXH



Date: 3.JUN.2005 11:53:43

Tx frequency: 2480MHz

Spurious Emissions - Radiated

Date: 17 Jun 2005

EUT: C51-A05015-xx

Company: i.Tech Dynamics

Voltage supply: 3.9VDC from AC/DC adapter

Test by: Sharon Li

Op. mode: TX mode, DH1 with PRBS9 payload

Tx frequency (MHz)	Polarization	Spurious Frequency (MHz)	Power Level (dBuV/m)	Detector (P/QP/A)
2402	V	228.32	19.9	QP
2402	V	267.62	23.3	QP
2402	V	200.00	21.3	QP
2402	V	4804.10	50.15	P
2402	V	4804.10	45.58	A
2402	H	231.84	25.2	QP
2402	H	266.30	26.0	QP
2402	H	1602.00	35.30	P
2402	H	1602.00	31.68	A

Tx frequency (MHz)	Polarization	Spurious Frequency (MHz)	Power Level (dBuV/m)	Detector (P/QP/A)
2441	V	227.08	19.4	QP
2441	V	266.42	23.0	QP
2441	V	4882.02	47.92	P
2441	V	4882.02	43.12	A
2441	H	228.26	22.8	QP
2441	H	268.70	25.1	QP
2441	H	1165.20	29.45	P
2441	H	1165.12	24.56	A
2441	H	4882.00	47.03	P
2441	H	4882.00	43.43	A

Tx frequency (MHz)	Polarization	Spurious Frequency (MHz)	Power Level (dBuV/m)	Detector (P/QP/A)
2480	V	223.56	21.1	QP
2480	V	267.68	22.4	QP
2480	H	225.92	22.2	QP
2480	H	269.80	23.1	QP
2480	H	4960.04	48.34	P
2480	H	4960.08	46.53	A