

Produkte
Products

Prüfbericht - Nr.: 14018245 001		Seite 1 von 33	
<i>Test Report No.:</i>		<i>Page 1 of 33</i>	
Auftraggeber: <i>Client:</i>	Chung Nam Electronics Co., Ltd. 12/F, Chung Nam Building, 1 Lockhart Road, Wan Chai Hong Kong		
Gegenstand der Prüfung: <i>Test item:</i>	EPC Class 1 Gen 2 UHF RFID Module		
Bezeichnung: <i>Identification:</i>	CS231-2	Serien-Nr.: <i>Serial No.</i>	Engineering sample
Wareneingangs-Nr.: <i>Receipt No.:</i>	080307001	Eingangsdatum: <i>Date of receipt:</i>	28.2.2008
Prüfört: <i>Testing location:</i>	TÜV Rheinland Hong Kong Ltd. 9/F., Oriental News Building, No.7 Wang Tai Road, Kowloon Bay, Kowloon, Hong Kong. Hong Kong Productivity Council HKPC Building, 78 Tat Chee Avenue, Kowloon, Hong Kong		
Prüfgrundlage: <i>Test specification:</i>	FCC Part 15, Subpart C		
Prüfergebnis: <i>Test Result:</i>	Der Prüfgegenstand entspricht oben genannter Prüfgrundlage(n). <i>The test item passed the test specification(s).</i>		
Prüflaboratorium: <i>Testing Laboratory:</i>	TÜV Rheinland Hong Kong Ltd.		
geprüft / tested by:		kontrolliert / reviewed by:	
14.3.2008	Derek Leung Project Manager	14.3.2008	Thomas Berns Manager
<i>Datum</i> <i>Date</i>	<i>Name/Stellung</i> <i>Name/Position</i>	<i>Unterschrift</i> <i>Signature</i>	<i>Unterschrift</i> <i>Signature</i>
			
Sonstiges / Other Aspects:		FCCID: Q72CS231C1GEN2	
Abkürzungen:	P(ass) = entspricht Prüfgrundlage F(ail) = entspricht nicht Prüfgrundlage N/A = nicht anwendbar N/T = nicht getestet	Abbreviations:	P(ass) = passed F(ail) = failed N/A = not applicable N/T = 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. <i>This test report relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any safety mark on this or similar products.</i>			

Test Result Summary

Clause	Test Item	Result
15.247(b)(2)	Conducted Peak RF Output Power Test	Pass
15.247(d)	Conducted Spurious RF Output Power Test	Pass
15.209	Spurious Radiated Emissions	Pass
15.247(a)(1)(i)	Bandwidth Occupancy	Pass
15.247(a)(1)(i)	Number of Hopping Channels	Pass
15.247(a)(1)	Carrier Frequency Separation	Pass
15.247(a)(1)(i)	Time of Occupancy	Pass
15.247(d)	Band-edge compliance	Pass
15.207	Conducted Emission Test on a.c. Power Line	Pass

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List of Test and Measurement Instruments

Kind of Equipment	Manufacturer	Model	Serial Number	Calibration Due Date
Test Receiver	Rohde & Schwarz	ESU26	100050	6 Aug 2008
Biconical Antenna	Rohde & Schwarz	HK116	841489/015	8 Mar 2009
Log-periodic Antenna	Rohde & Schwarz	HL223	841516/017	28 Feb 2009
Active Loop Antenna	EMCO	6502	9107-2651	20 Dec 2009
Horn Antenna	EMCO	3115	9002-3347	2 Feb 2009
Spectrum Analyzer	Rohde & Schwarz	FSP30	1093.4495K30	28 Feb 2010

General Product Information

Product Function and Intended Use

The equipment under test (EUT) CS231-2 RFID module is an EPCglobal Class 1 Gen 2 RFID module providing real-time tag processing for Class 1 (Read / Write) EPC- compliant tag. The system output power is selectable from 15dBm to 27dBm and operates in the 902 to 928MHz frequency band. Detail specifications of the EUT refer to appendix 6.

Ratings and System Details

FCC ID	:	UB4CS2312C1GEN2
Operating Frequency	:	902.75MHz to 927.25MHz
No. of RF channel	:	50 channels
Channel Spacing	:	500kHz
RF port	:	MMCX
Power supply	:	+4.2 Volt, Max.
Port(s)	:	(i) USB port (ii) RS232 port (iii) DC power jack

Operation Descriptions

The CS231-2 RFID module hops among 50 channels (Ch.1 - 50) from 902.75MHz to 927.25MHz in 500kHz steps in operating mode according to a generated pseudo-random sequence. The time of occupancy on each frequency is 0.4 seconds maximum within a 20 seconds period.

Each CS231-2 module hops among its 50 available channels according to an independently generated pseudo-random sequence. The module maintains no capability to coordinate RF channel occupancy among separate units. Within each hop, the RFID module may be sending command to the tag or receiving backscatter from the tag, alternating between them as required by the EPC Gen 2 protocol. When the module is sending command to the tag, the reader is sending out modulated signal. When the reader is receiving backscatter from the tag, the reader is sending out continuous wave signal. The receiver of the module has input bandwidths that match the hopping channel bandwidths of its corresponding transmitter and shifts frequencies in synchronization with the transmitted signal. The power measured at the port can be adjusted from 15dBm to maximum 27dBm.

The system supports six preset profiles of operational configurations. The details of the settings of each profile are shown in table:

Profile	Tari (µs)	Reader to Tag Forward Link Modulation	Pulse Width (µs)	Tag to Reader Link Frequency (kHz)	Tag to Reader Reverse Modulation
0	25.00	PR-ASK	12.50	120	Miller, M=4
1	12.50	DSB-ASK	6.25	160	Miller, M=2
2	25.00	PR-ASK	12.50	250	Miller, M=4
3	25.00	PR-ASK	12.50	300	Miller, M=4
4	6.25	DSB-ASK	3.13	400	FM0
5	25.00	PR-ASK	12.50	250	Miller, M=2

Glossary:

Tari: time interval of symbol 0

Forward Link: modulation method of reader to tag link

Pulse Width: time width of RF pulse at power below average power level

Link Frequency: data rate of tag to reader link

Reverse Modulation: Encoding method of the tag to reader link (either FM0 or Miller subcarrier)

Test Set-up and Operation Mode

Principle of Configuration Selection

Emission: The test was performed under test mode to obtain the maximum emissions.

Test Operation and Test Software

Testing software was used to enable the continuous transmission and frequency hopping on the EUT for the tests in this report.

Special Accessories and Auxiliary Equipment

The EUT was tested together with the following additional accessory:

- Notebook computer for controlling different transmit channels, transmit profiles and power levels, and also used to enable the frequency hopping.
- Antenna, model: CS718-2.
- an ac/dc adapter was provided by client for the ac mains line conducted emission test:
Model: LGSPS050200
Input: 100-240Vac, 50/60Hz.
Output: 5V dc, 2000mA.

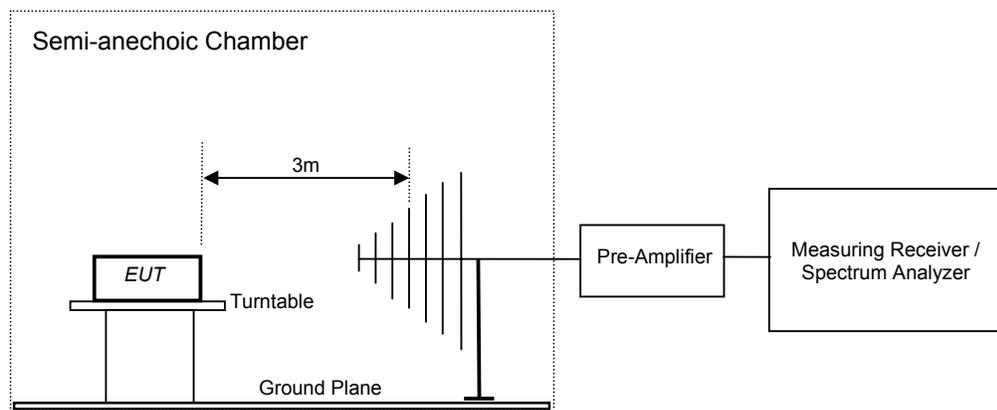
Countermeasures to achieve EMC Compliance

- none

Test Methodology

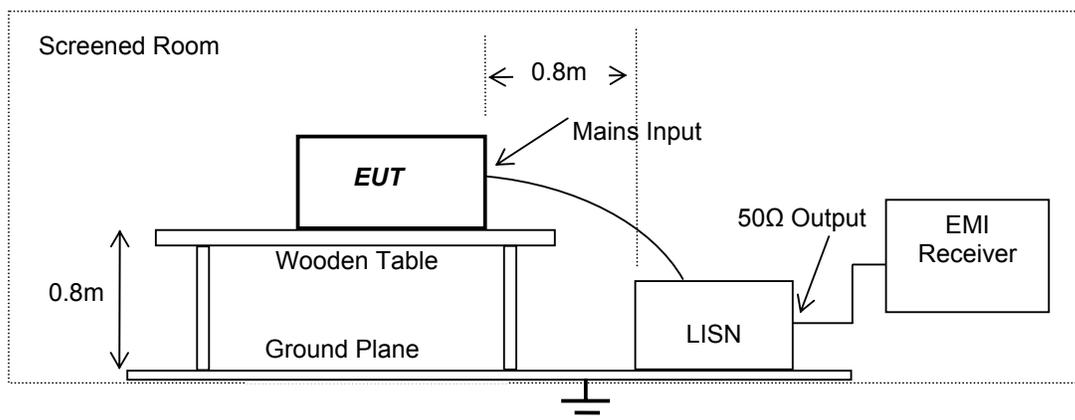
Radiated Emission Test

The radiated emission measurement was performed according to the procedures in ANSI C63.4-2003. The equipment under test (EUT) was placed at the middle of the 80 cm high turntable, and the EUT is 3 meters far from the measuring antenna. The turntable was rotated 360° for obtaining the maximum emission. The height of the measuring antennas was scanned between 1m and 4m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. Repeat the measurement steps until the maximum emissions were obtained. The measurement above 1000MHz was performed by horn antenna. The measurement below 30MHz was performed by loop antenna.



Conducted Emission Test on a.c. mains line

The equipment under test (EUT) was placed on a wooden table 80cm above the ground plane, the LISN was placed 80cm away from the EUT. The test was performed in accordance with ANSI C63.4: 2003, with the following: an initial measurement was performed in peak and average detection mode on the live and neutral lines. The pre-scan was performed by peak detection on both live and neutral conductors. Any emissions recorded within 20dB of the relevant limit line were re-measured using quasi-peak and average detections, the 6 worst cases was recorded in the table of results.



Test Results

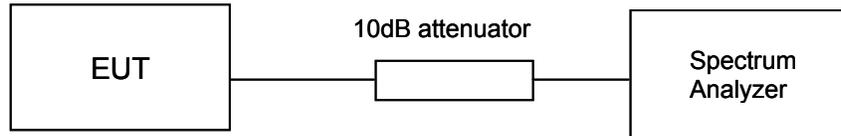
Conducted Peak Output Power

Section 15.247(b)(2)

RESULT:
Pass

Test Specification : FCC Part 15 Section 15.31
 Test Method : ANSI C63.4-2003
 Measurement Bandwidth (RBW) : 100kHz
 Detector : Peak
 Supply voltage : 4.2 Volt DC
 Requirement : <1 watt (30dBm) for system employing at least 50 hopping channels

Test Method:



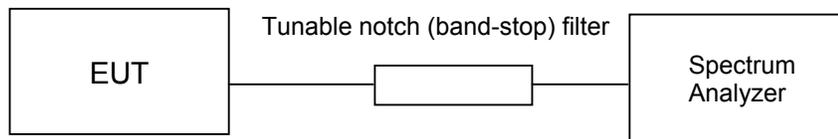
Test Result:

Transmit Channel	Transmit Channel Frequency (MHz)	Transmit Profile	RF Output Power (dBm)	Limit (dBm)	Margin (dB)
1	902.75	0	26.7	30	-3.3
	902.75	1	27.0	30	-3.0
	902.75	2	26.8	30	-3.2
	902.75	3	26.8	30	-3.2
	902.75	4	25.4	30	-4.6
	902.75	5	26.7	30	-3.3
26	915.25	0	26.7	30	-3.3
	915.25	1	26.7	30	-3.3
	915.25	2	26.6	30	-3.4
	915.25	3	26.6	30	-3.4
	915.25	4	25.2	30	-4.8
	915.25	5	26.8	30	-3.2
50	927.25	0	26.8	30	-3.2
	927.25	1	26.6	30	-3.4
	927.25	2	26.8	30	-3.2
	927.25	3	26.5	30	-3.5
	927.25	4	25.9	30	-4.1
	927.25	5	27.0	30	-3.0

Conducted Spurious RF Output Power Test
Section 15.247(d)
RESULT:
Pass

Test Specification : FCC Part 15 Section 15.31
 Test Method : ANSI C63.4-2003
 Detector Function : Peak
 Supply Voltage : 4.2 Volt DC
 Measuring Frequency Range : 15MHz (Lowest internal oscillator frequency of 18.432MHz) – 10GHz (Up to 10th harmonic of the highest fundamental frequency)
 Measurement bandwidth(RBW) : 15MHz-1GHz: 100kHz, above 1GHz: 1MHz
 Requirement : At least 20dB below that in the 100kHz 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 limit.

Test Method:



Test Result:

Tx Channel	Tx Channel Freq (MHz)	Tx Profile	Spurious Emission (MHz)	Spurious RF Power (dBm)	Limit (dBm)	Margin (dB)
1	902.75	0	-	<-65	10	<-75
1	902.75	4	-	<-65	10	<-75
26	915.25	1	1832.0	-52.1	10	-62.1
			2748.0	-62.1	10	-72.1
26	915.25	3	-	<-65	10	<-75
50	927.25	2	-	<-65	10	<-75
50	927.25	5	-	<-65	10	<-75

All other emissions are below -65dBm.

Spurious Radiated Emissions**Section 15.209****RESULT:****Pass**

Test Specification	:	FCC Part 15 Section 15.205, 15.209 & 15.247(d)
Test Method	:	ANSI C63.4-2003
Measurement Location	:	Semi Anechoic Chamber
Supply Voltage	:	4.2 Volt DC
Measuring Frequency Range	:	15MHz (Lowest internal oscillator frequency of 18.432MHz) – 10GHz(Up to 10 th harmonic of the highest fundamental frequency)
Antenna connected with EUT	:	4.5dBi gain patch antenna provided by client.
Measuring Distance	:	3m
Detection	:	QP for frequency below 1GHz, Average for frequency above 1GHz
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, provided the transmitter demonstrates compliance with the peak conducted power limits. Attenuation below the general limits specified in Sections 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a).

Test result:

Channel	Fundamental Carrier Signal (MHz)	Tx Profile	Antenna Polarization	Spurious Emission (MHz)	Field Strength at 3m (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
1	902.75	4	V	72.483	32.0	#	#
				138.150	25.4	#	#
				909.249	43.8	#	#
				921.249	44.5	#	#
				932.249	44.2	#	#
				8124.808	50.6	54.0	3.6
			H	141.660	31.0	#	#
				932.249	34.2	#	#
26	915.25	0	V	72.480	31.8	#	#
				138.360	29.8	#	#
				908.749	45.9	#	#
				921.749	45.5	#	#
				932.749	39.1	#	#
				1830.593	39.6	#	#
			H	143.717	32.5	#	#
				144.156	29.5	#	#
				908.749	35.9	#	#
				1830.417	43.5	#	#
			2745.673	40.3	54.0	13.7	
50	927.25	1	V	72.498	31.9	#	#
				132.143	29.4	43.5	-14.1
				897.749	46.2	#	#
				909.749	48.8	#	#
				944.749	40.1	#	#
				1854.503	40.9	#	#
				8345.240	51.6	54.0	2.4
			H	141.240	29.7	#	#
				909.749	37.4	#	#
				1854.503	46.9	#	#

Spurious emissions that do not fall into the restricted band of Section 15.205.

Limit for Radiated Emission of Section 15.209:

Frequency (MHz)	Field strength (dB μ V) at 3m range	Field strength (dB μ V/m) at 3m range
1.705-30	30 (30m range)*	29.5(30m range)*
30-88	100	40.0
88-216	150	43.5
216-960	200	46.0
Above 960	500	54.0

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Remark: * the limit shows in the table above of frequency range 1.705-30MHz are at 30 meter range, which corresponds to 49.5dB μ V/m at 3m range by extrapolation calculation and the measurement of loop antenna.

The emission limits shows in the table are based on measurements employing a CISPR quasi-peak detector and above 1000 MHz are based on the measurements employing an average detector.

Bandwidth Occupancy

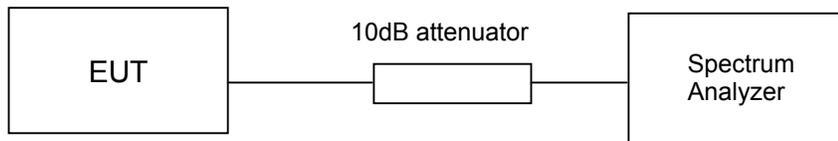
Section 15.247(a)(1)(i)

RESULT:

Pass

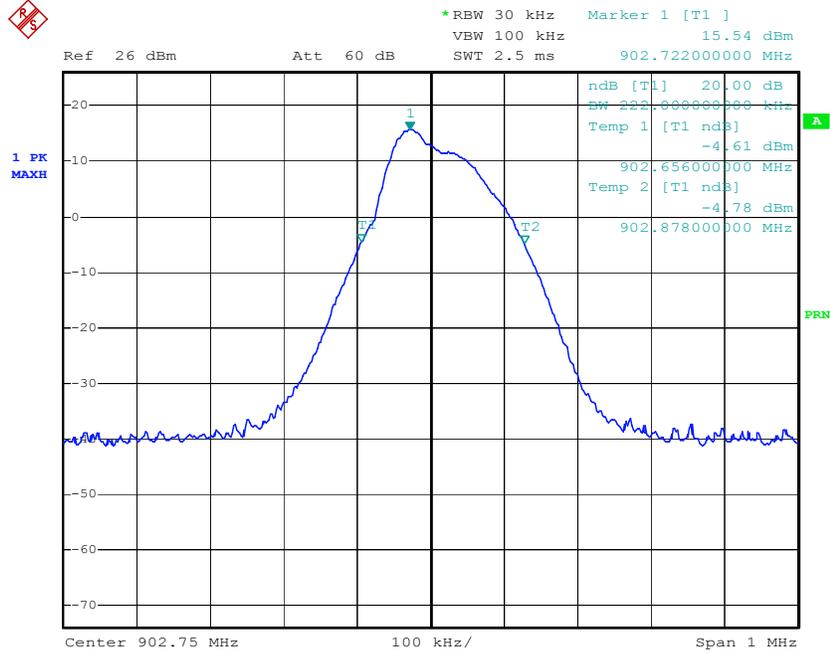
Test Specification : FCC Part 15 Section 15.247 (a) (1) (i)
 Detector Function : Peak
 Supply Voltage : 4.2 Volt DC
 Port of testing : Antenna port
 Requirement : For frequency hopping systems operating in the 902 – 928MHz; if the 20dB bandwidth is less than 250kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period;
 If the 20dB bandwidth of the hopping channel is 250kHz or greater, the system shall use at least 25 frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period.
 The maximum allowed 20dB bandwidth of the hopping channel is 500kHz.

Test Method:

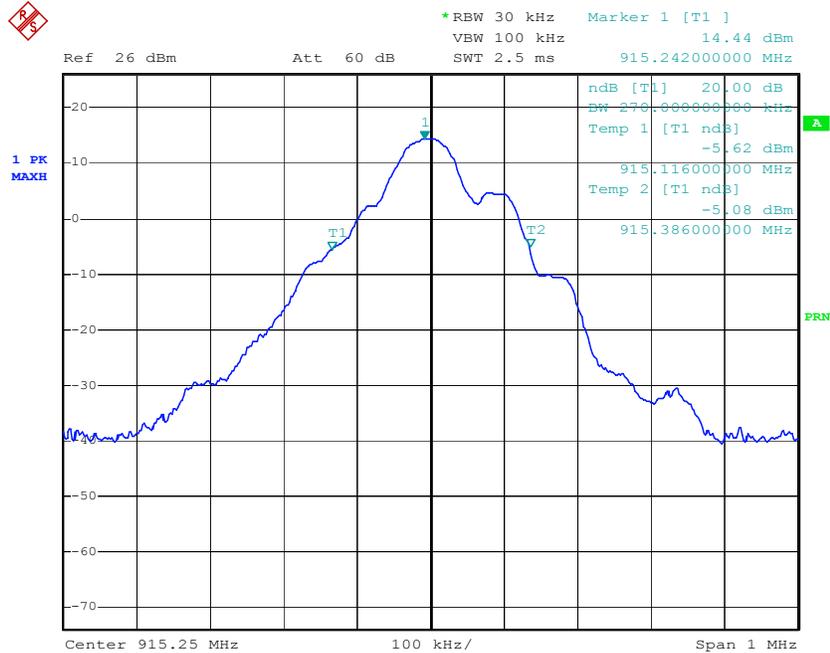


Test Result:

Frequency (MHz)	Tx Profile	20dB Bandwidth (kHz)
Channel 1 - 902.75	0	222.0
Channel 26 - 915.25	1	270.0
Channel 50 - 927.25	2	198.0
Channel 1 - 902.75	3	192.0
Channel 26 - 915.25	4	462.0
Channel 50 - 927.25	5	204.0

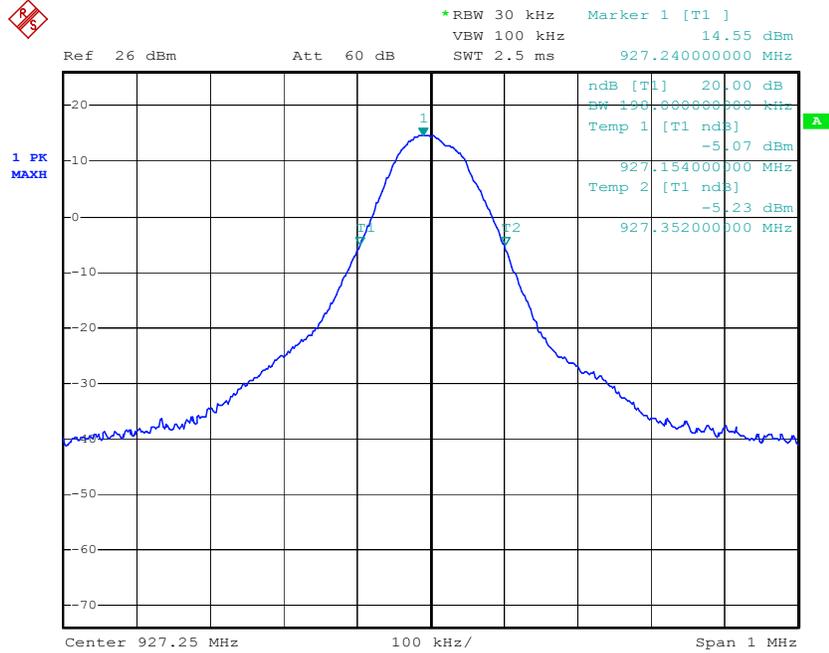


Date: 4.MAR.2008 21:19:44

20dB Bandwidth Measurement - Channel 1, Profile 0


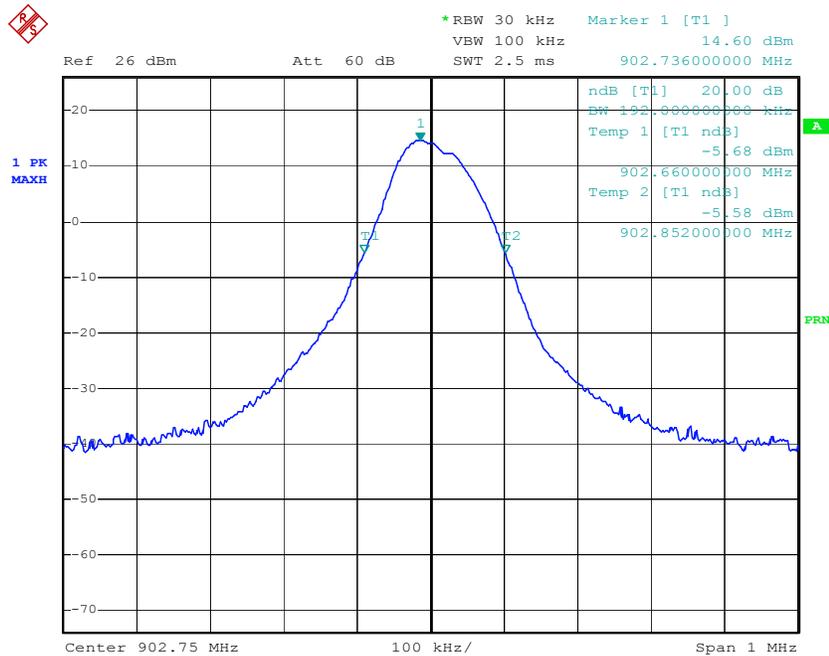
Date: 4.MAR.2008 21:21:01

20dB Bandwidth Measurement - Channel 26, Profile 1



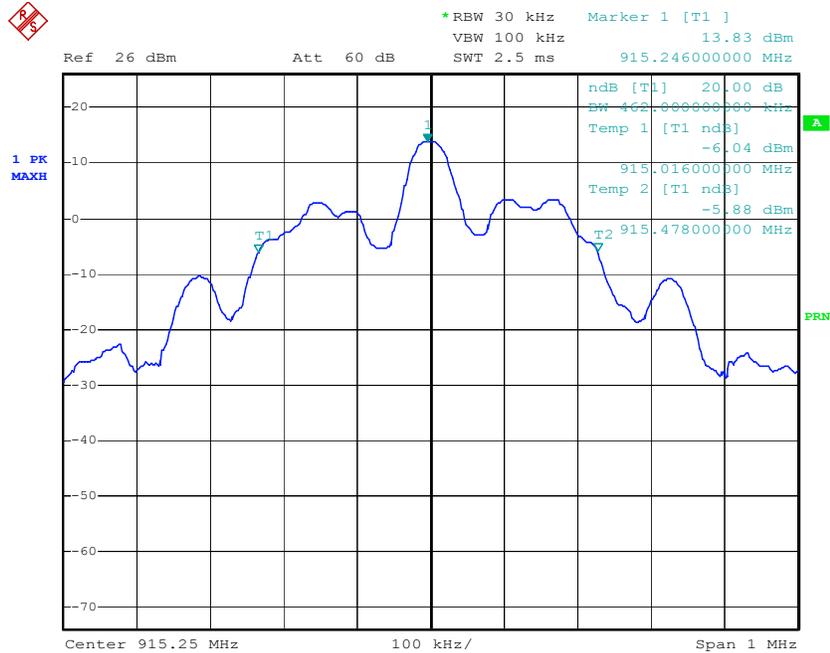
Date: 4.MAR.2008 21:22:23

20dB Bandwidth Measurement - Channel 50, Profile 2



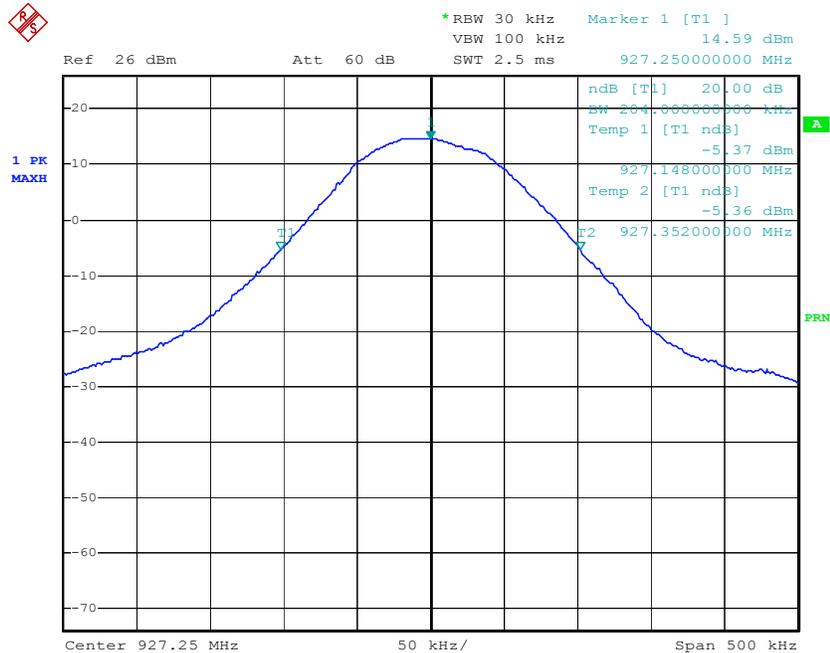
Date: 4.MAR.2008 21:29:56

20dB Bandwidth Measurement - Channel 1, Profile 3



Date: 4.MAR.2008 21:32:24

20dB Bandwidth Measurement - Channel 26, Profile 4



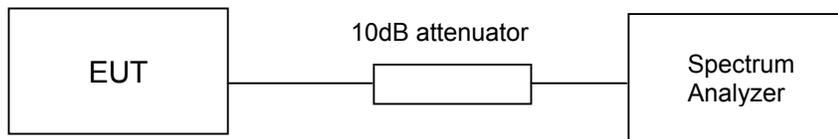
Date: 9.MAR.2008 13:19:39

20dB Bandwidth Measurement - Channel 50, Profile 5

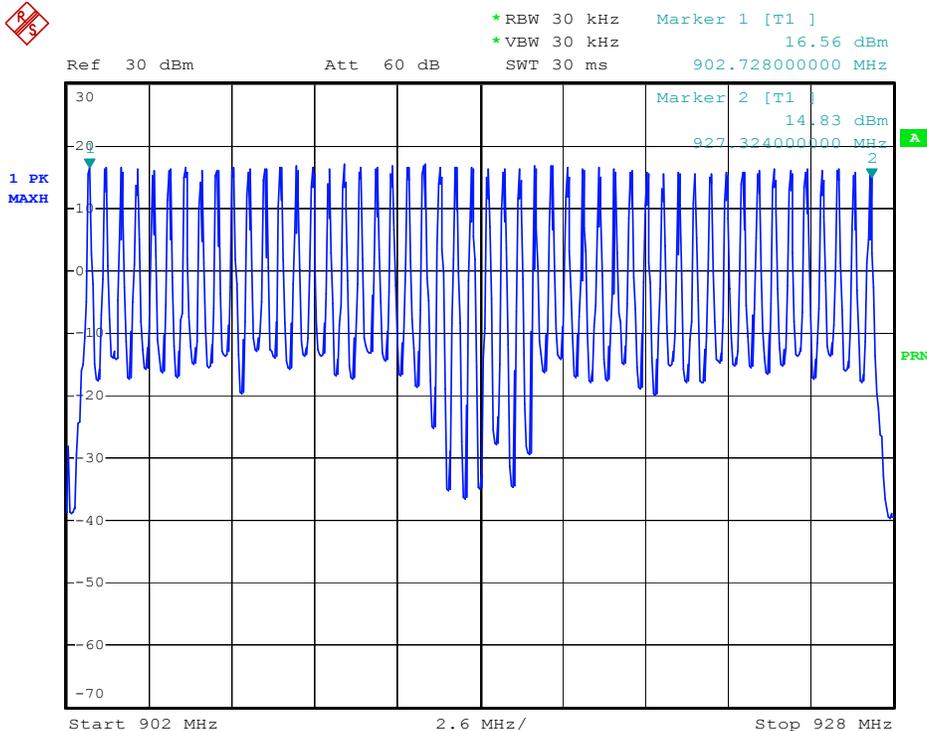
Number of Hopping Channels
Section 15.247(a)(1)(i)
RESULT:
Pass

Test Specification : FCC Part 15 Section 15.247(a)(1)(i)
 Detector Function : Peak
 Supply Voltage : 4.2 Volt DC
 Port of testing : Antenna port
 Requirement : For frequency hopping systems operating in the 902 – 928MHz; if the 20dB bandwidth is less than 250kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period.; If the 20dB bandwidth of the hopping channel is 250kHz or greater, the system shall use at least 25 frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period.

Test Method:



Test Result:



Date: 9.MAR.2008 16:11:59

Number of Hopping Channels – 50 channels

Carrier Frequency Separation

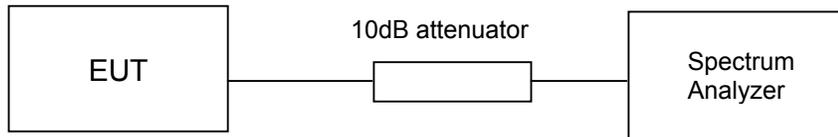
Section 15.247(a)(1)

RESULT:

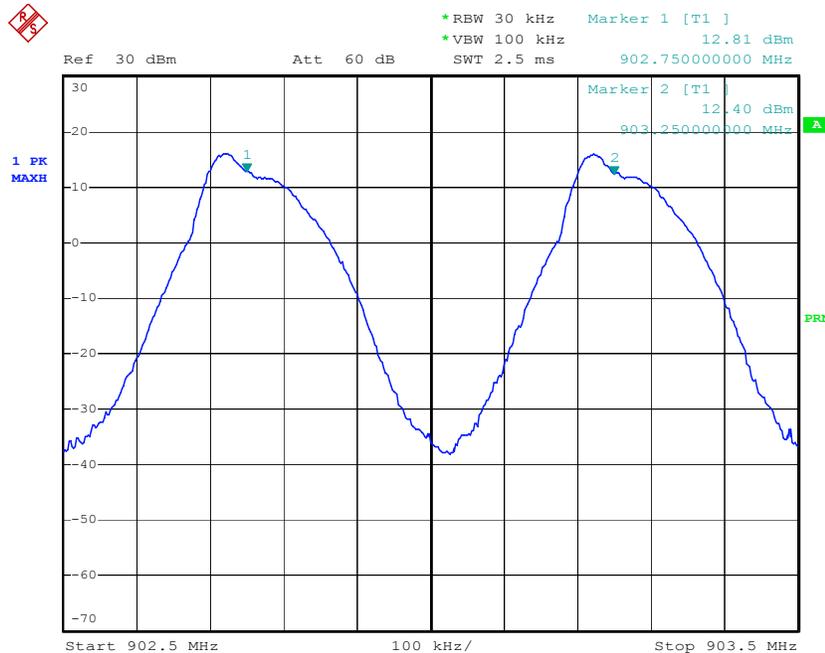
Pass

Test Specification : FCC Part 15 Section 15.247(a)(1)
 Detector Function : Peak
 Supply Voltage : 4.2 Volt DC
 Port of testing : Antenna port
 Requirement : Frequency hopping systems shall have hopping channel carrier frequency separated by a minimum of 25kHz or the 20dB bandwidth of the hopping channel, whichever is greater. The 20dB bandwidth of the EUT is 462kHz at maximum (from the bandwidth measurement result), and the carrier frequency separation is 500kHz, so it complies with the requirement.

Test Method:

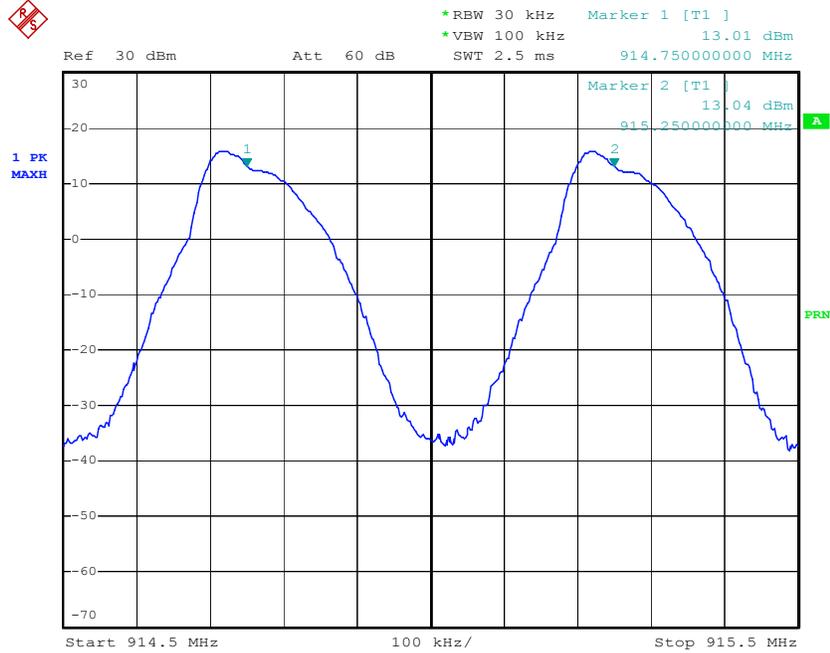


Test Result:



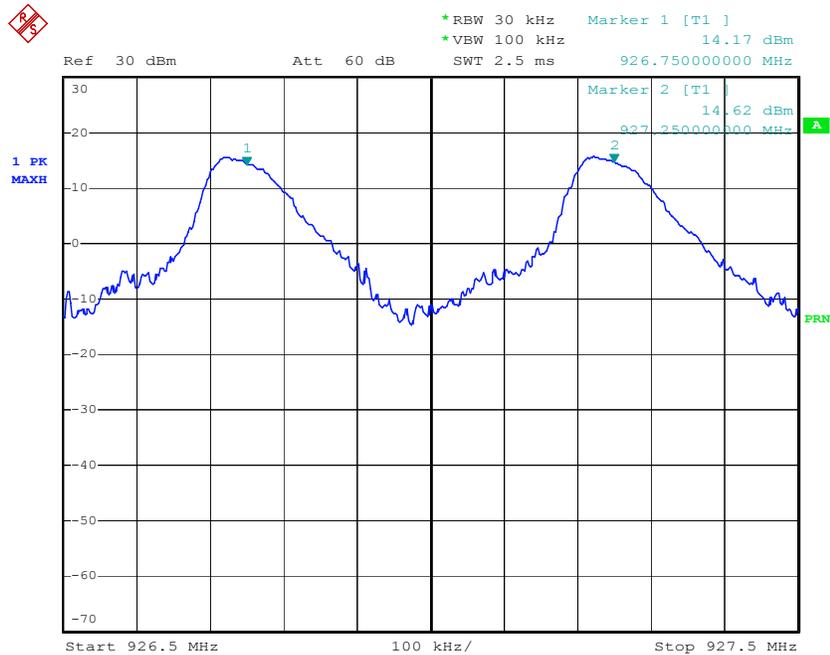
Date: 9.MAR.2008 13:37:44

Channel 1 and 2 – Channel Separation



Date: 9.MAR.2008 13:31:14

Channel 25 and 26 – Channel Separation



Date: 9.MAR.2008 13:34:03

Channel 49 and 50 – Channel Separation

Time of Occupancy (Dwell Time)

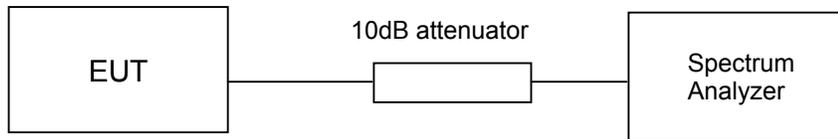
Section 15.247(a)(1)(i)

RESULT:

Pass

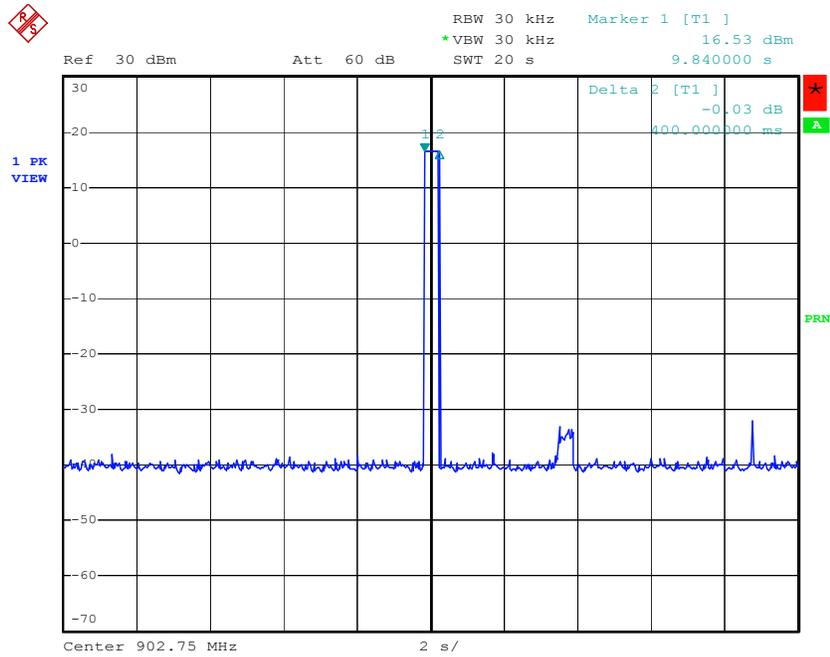
Test Specification : FCC Part 15 Section 15.247 (a) (1) (i)
 Detector Function : Peak
 Supply Voltage : 4.2 Volt DC
 Requirement : For frequency hopping systems operating in the 902 – 928MHz; if the 20dB bandwidth is less than 250kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period;
 If the 20dB bandwidth of the hopping channel is 250kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4seconds within a 10 second period.

Test Method:



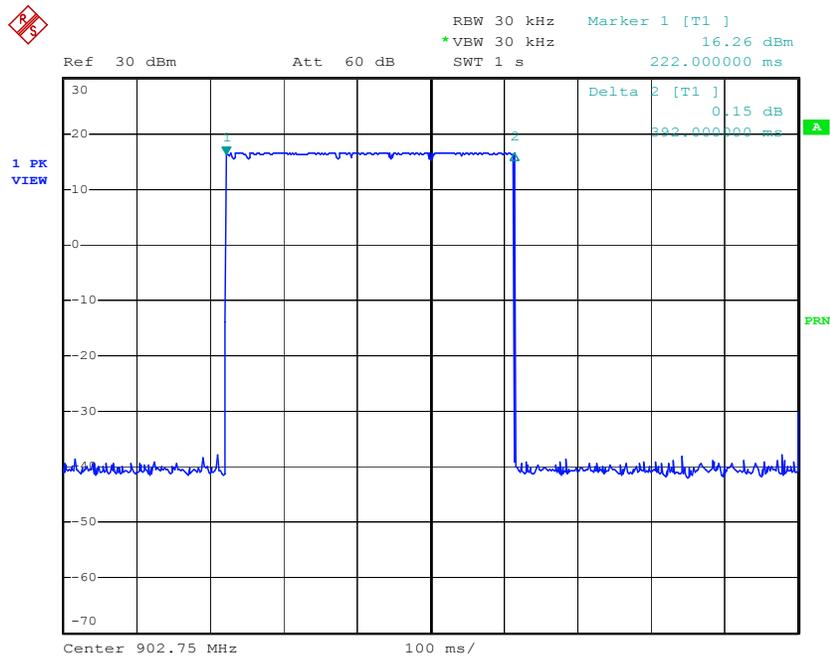
Test Result:

Transmit Channel	Transmit Profile	Dwell time (ms) within a 20 second period
1	0	392
26	0	386
50	0	394
26	1	392
26	2	392
26	3	392
26	4	394
26	5	392



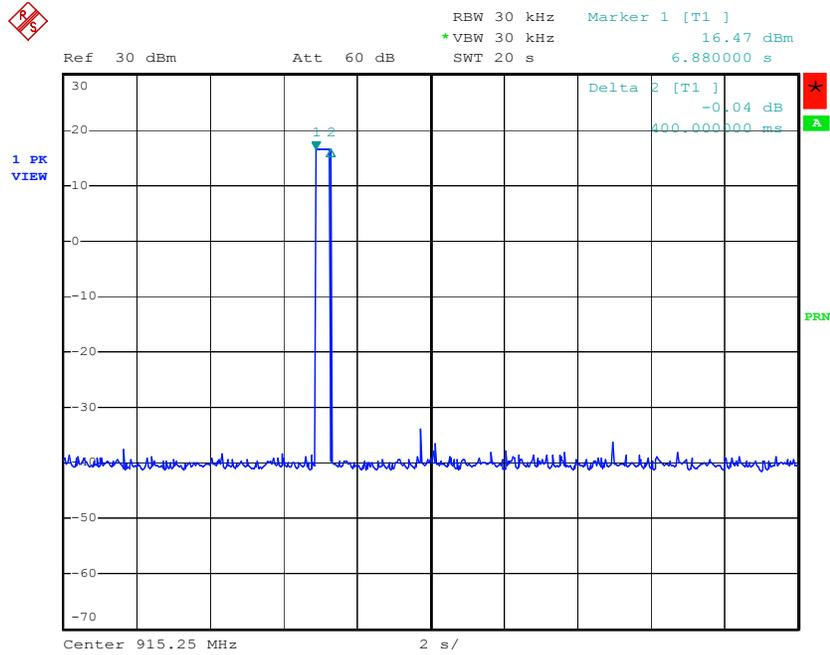
Date: 9.MAR.2008 14:19:39

Channel: 1, Profile: 0, Scan time: 20 seconds



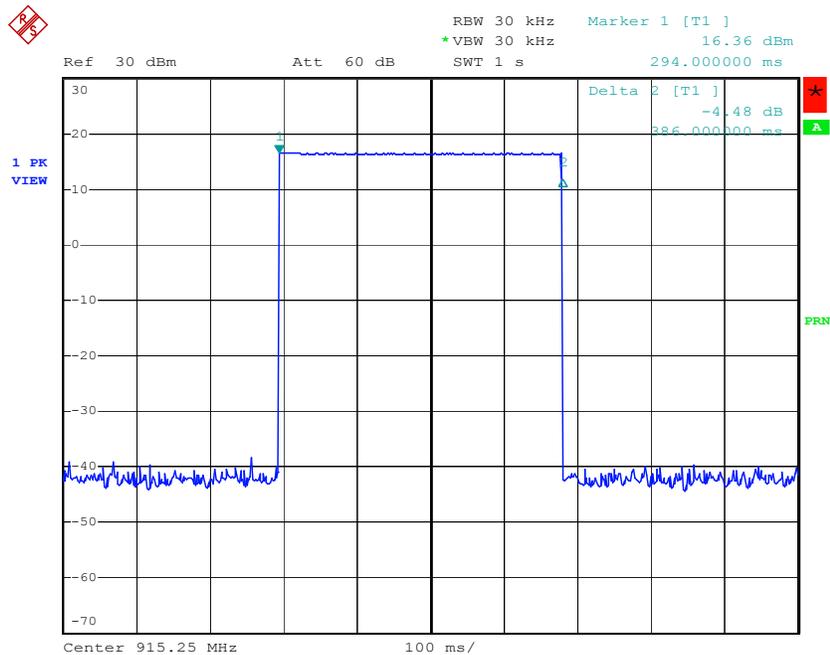
Date: 9.MAR.2008 14:23:17

Channel: 1, Profile: 0, Scan time: 1 second



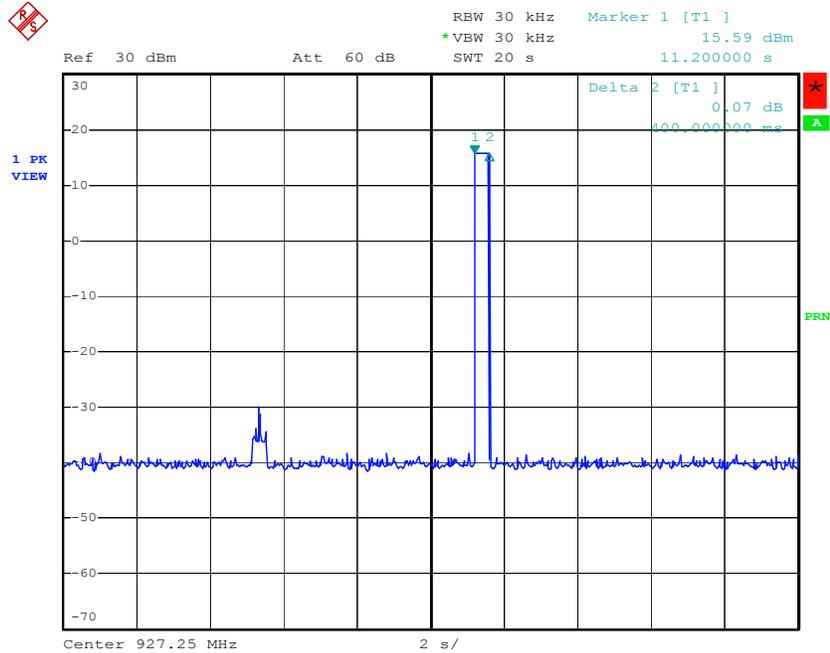
Date: 9.MAR.2008 14:38:50

Channel: 26, Profile: 0, Scan time: 20 seconds



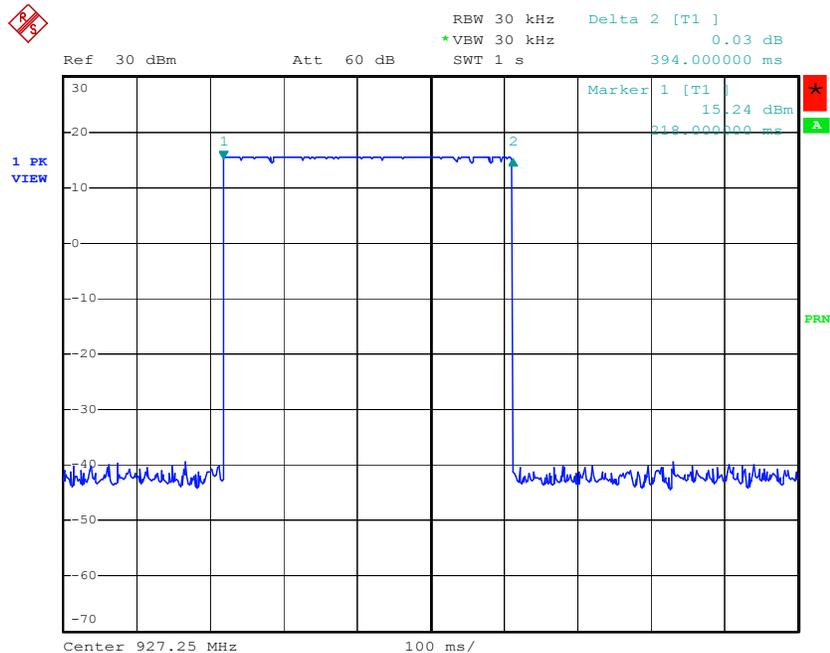
Date: 9.MAR.2008 14:36:26

Channel: 26, Profile: 0, Scan time: 1 second



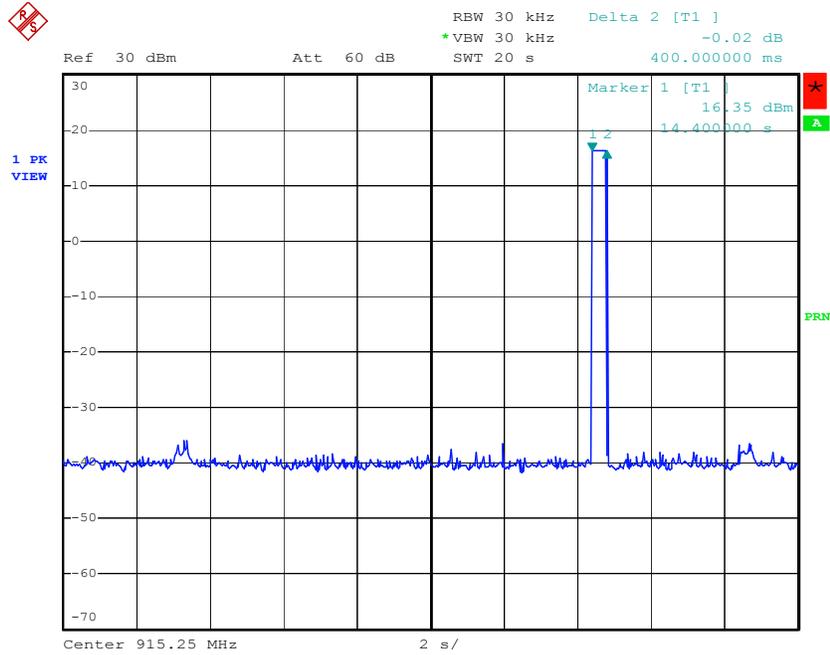
Date: 9.MAR.2008 14:49:04

Channel: 50, Profile: 0, Scan time: 20 seconds



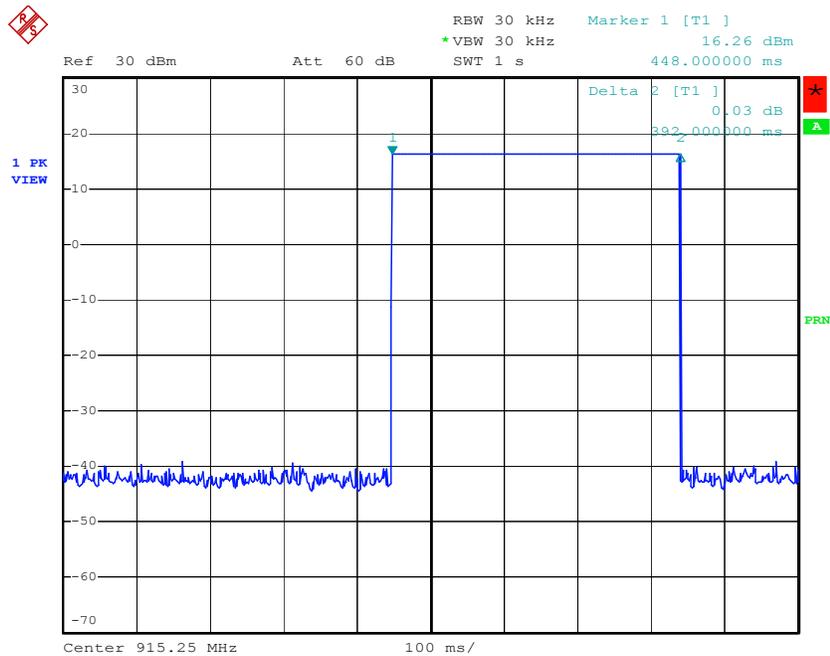
Date: 9.MAR.2008 14:51:39

Channel: 50 Profile: 0, Scan time: 1 second



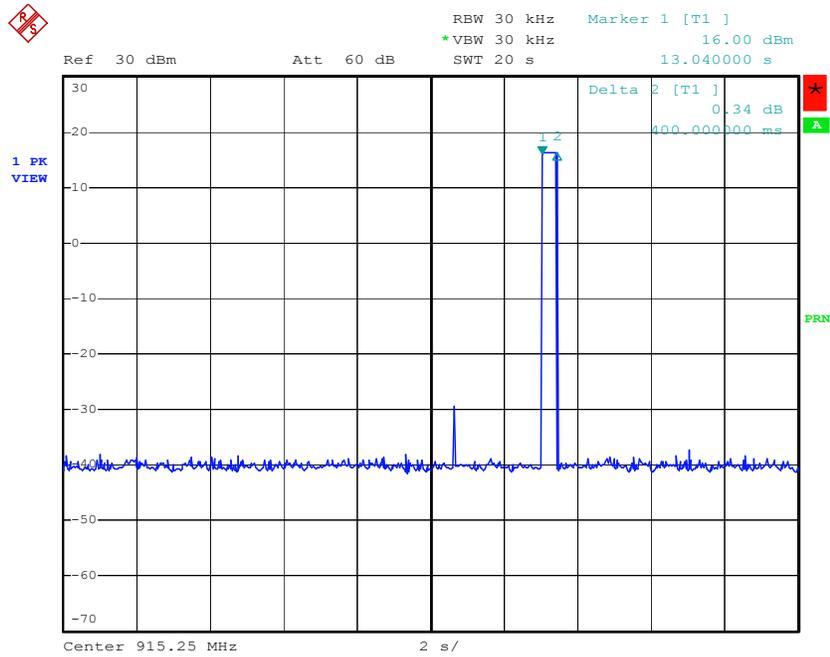
Date: 9.MAR.2008 14:54:23

Channel: 26, Profile: 1, Scan time: 20 seconds



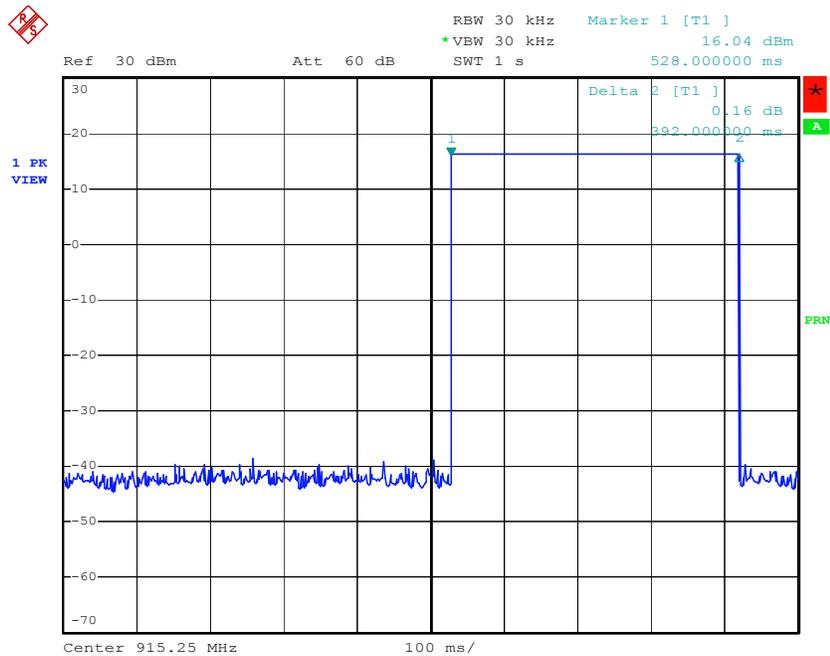
Date: 9.MAR.2008 14:56:01

Channel: 26, Profile: 1, Scan time: 1 second



Date: 9.MAR.2008 14:57:36

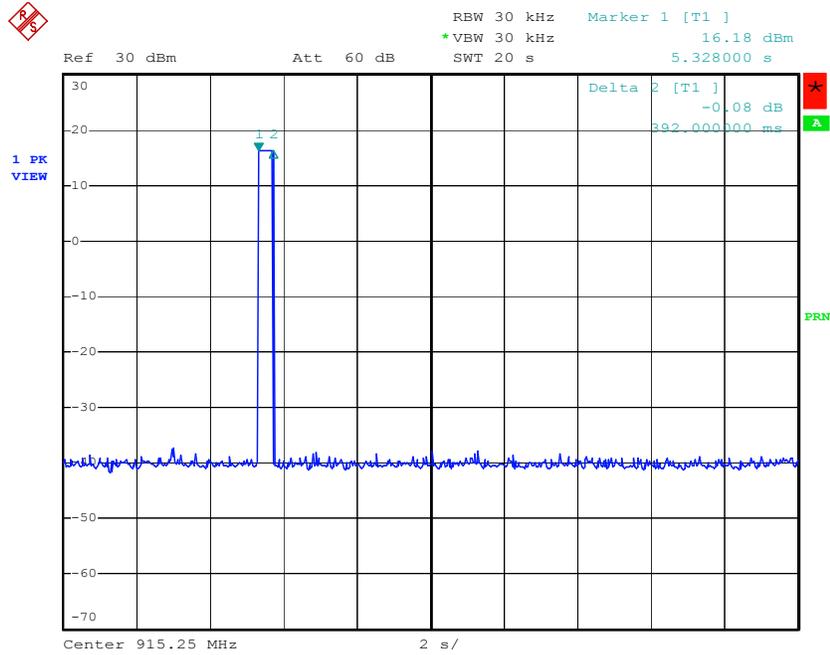
Channel: 26, Profile: 2, Scan time: 20 seconds



Date: 9.MAR.2008 15:04:42

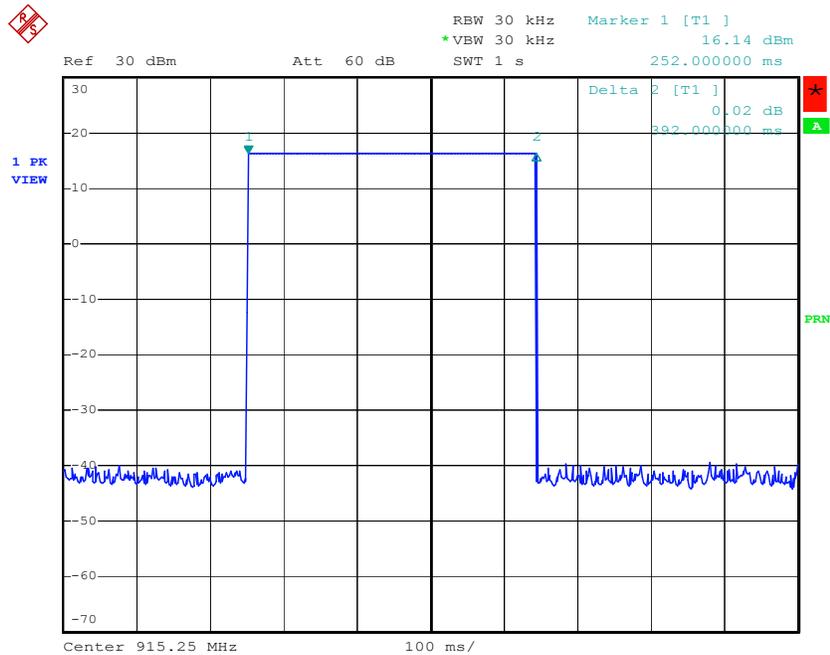
Channel: 26, Profile: 2, Scan time: 1 second

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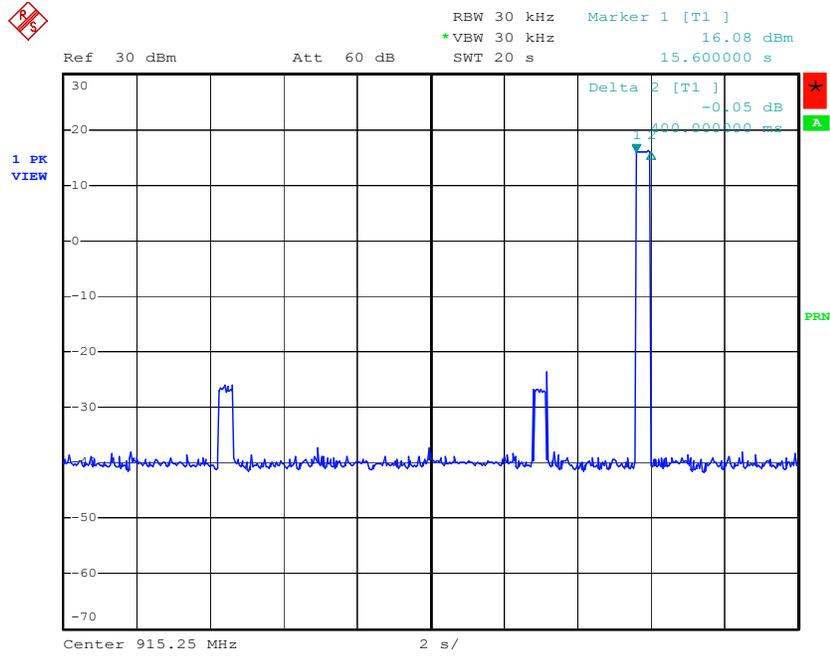
Date: 9.MAR.2008 15:06:38

Channel: 26, Profile: 3, Scan time: 20 seconds



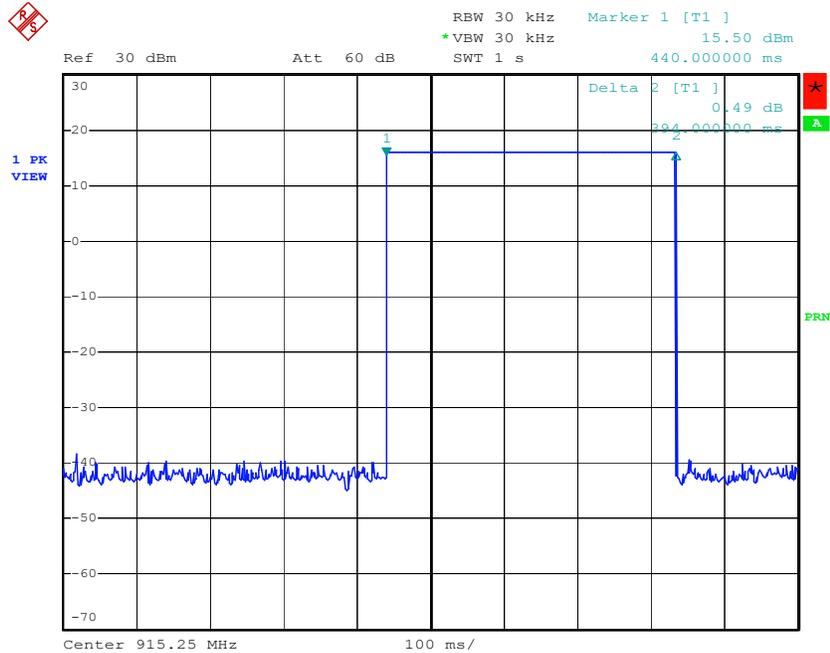
Date: 9.MAR.2008 15:07:55

Channel: 26, Profile: 3, Scan time: 1 second



Date: 9.MAR.2008 15:15:28

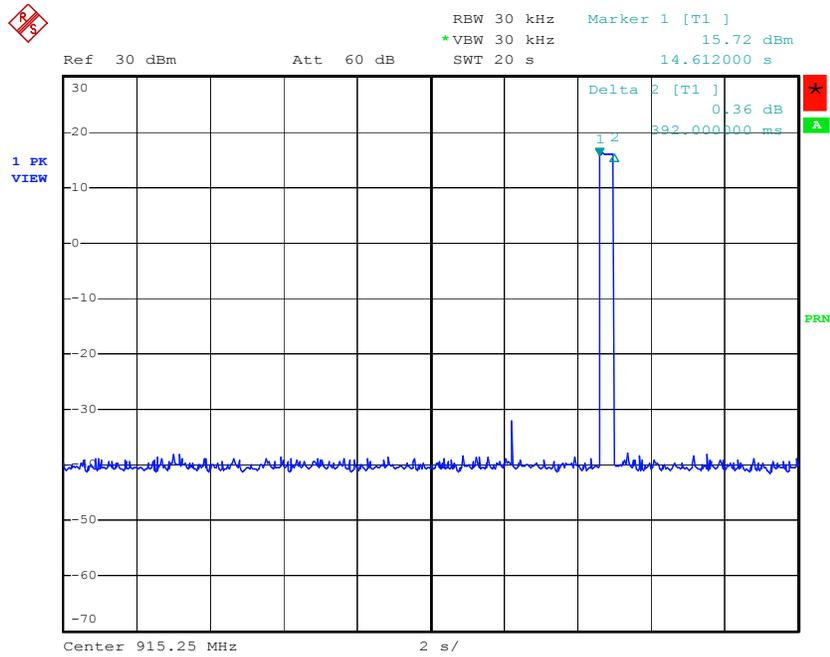
Channel: 26, Profile: 4, Scan time: 20 seconds



Date: 9.MAR.2008 15:16:48

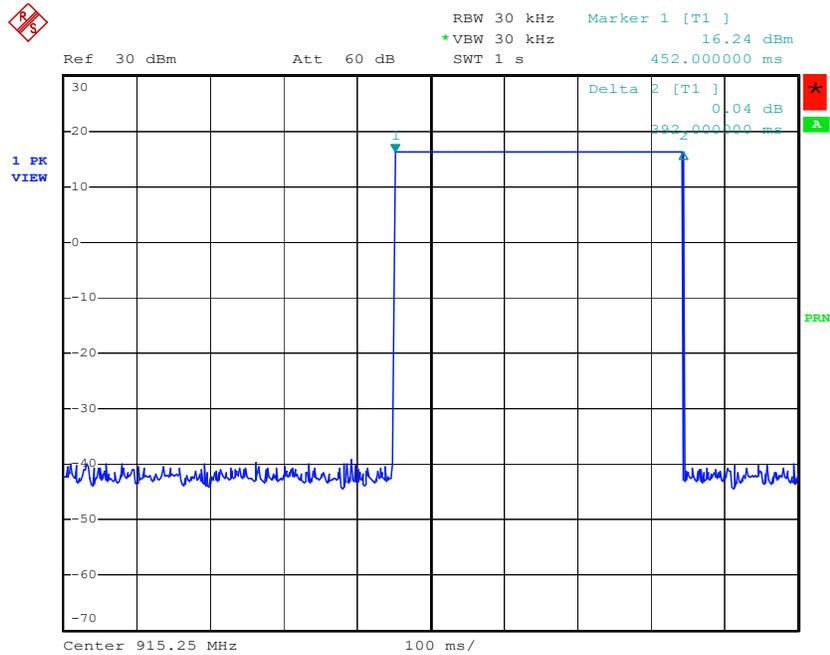
Channel: 26, Profile: 4, Scan time: 1 second

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Date: 9.MAR.2008 15:30:35

Channel: 26, Profile: 5, Scan time: 20 seconds



Date: 9.MAR.2008 15:20:16

Channel: 26, Profile: 5, Scan time: 1 second

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Band-edge Compliance

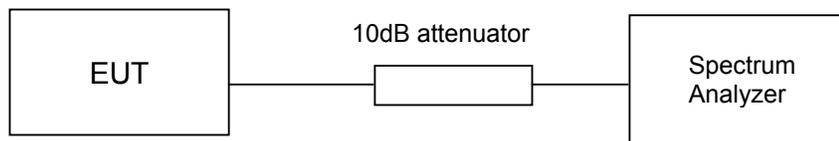
Section 15.247(d)

RESULT:

Pass

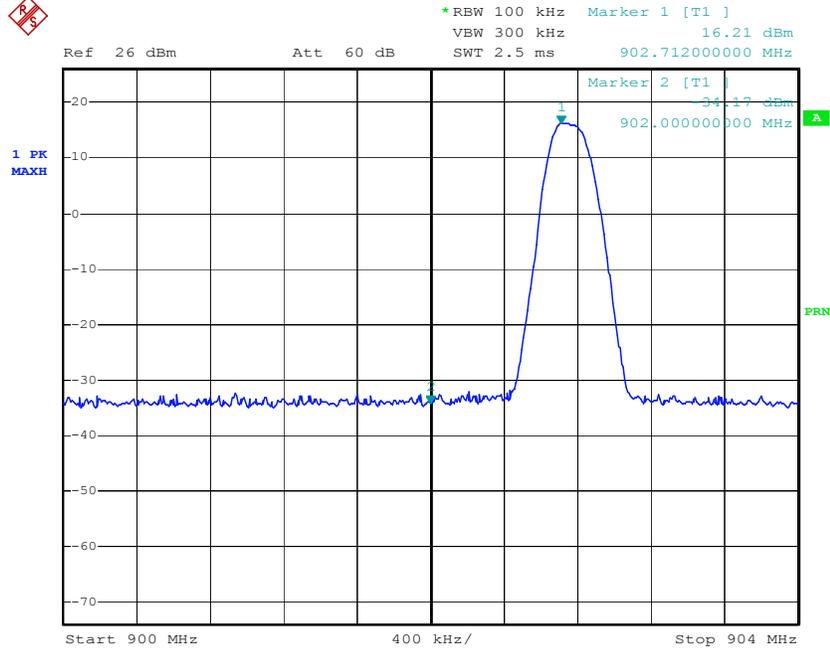
Test Specification : FCC Part 15 Section 15.247(d)
Detector Function : Peak
Supply Voltage : 4.2 V DC
Requirement : In any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz 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.

Test Method:



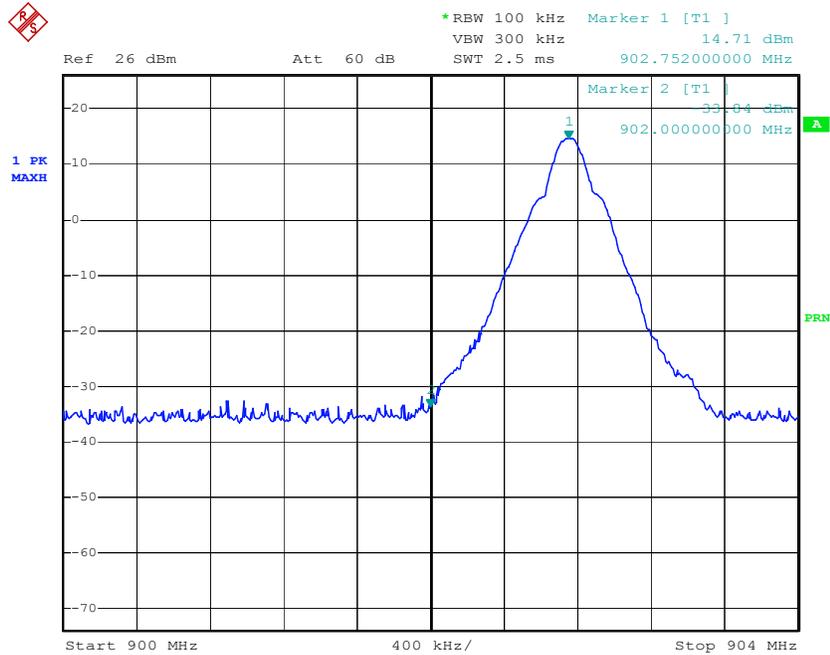
www.tuv.com

Test Result:



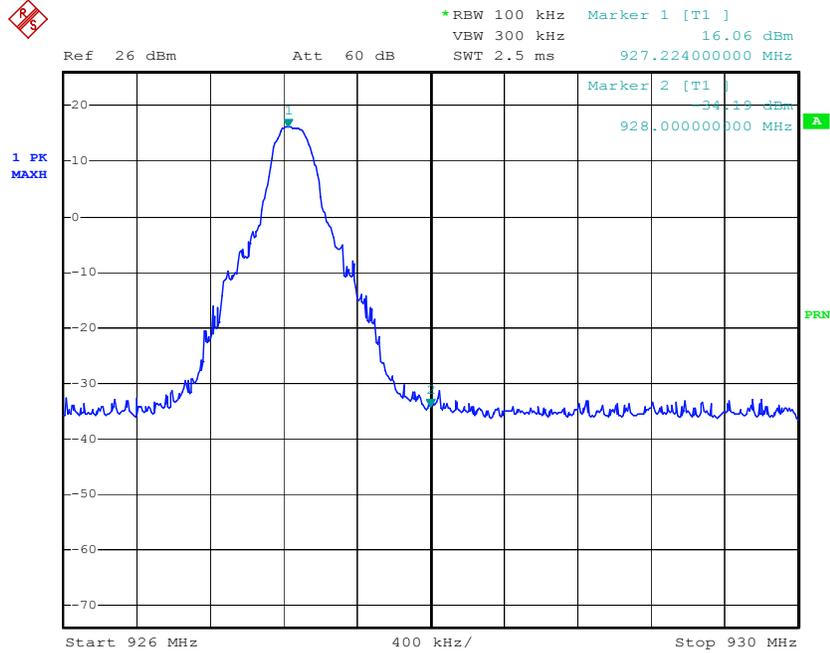
Date: 4.MAR.2008 21:39:29

Band-edge Measurement - Channel 1, Profile 0



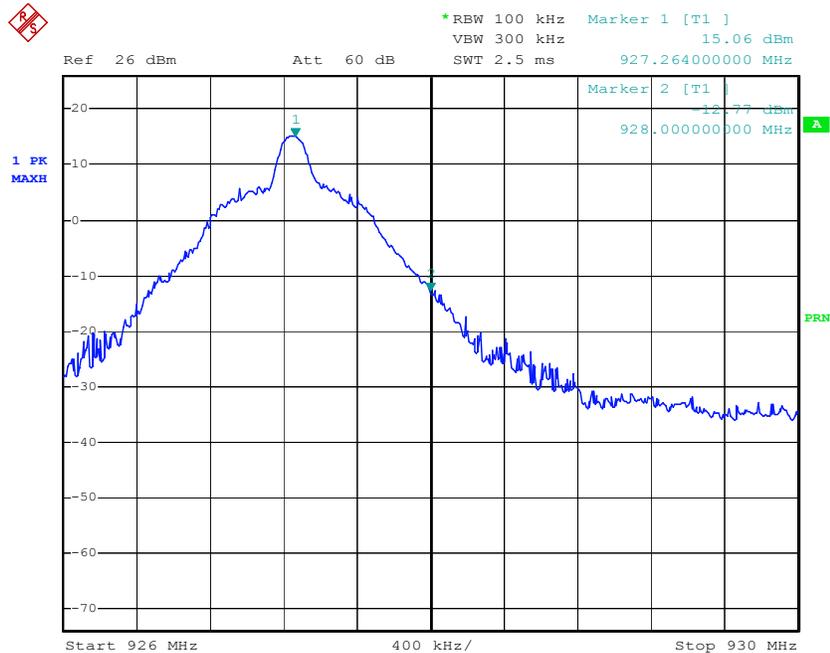
Date: 4.MAR.2008 21:40:15

Band-edge Measurement - Channel 1, Profile 4



Date: 4.MAR.2008 21:42:12

Band-edge Measurement - Channel 50, Profile 0



Date: 4.MAR.2008 21:44:34

Band-edge Measurement - Channel 50, Profile 4

Conducted Emission Test on a.c. Power Line
Section 15.207
RESULT:
Pass

Test Specification : FCC Part 15 Section 15.207
 Test Method : ANSI C63.4-2003
 Testing Location : Screened room
 Measurement Bandwidth : 9kHz
 Frequency Range : 150kHz – 30MHz
 Supply Voltage : 110 V ac

Tx RF Channel	Transmit Profile	Conductor	Frequency of Emission	Emission Level (QP)	Emission Level (AV)
			(MHz)	(dB μ V)	(dB μ V)
1	4	L	0.228	48.2	35.7
			0.342	40.2	29.5
			0.912	36.3	22.2
			2.922	38.4	28.7
		N	0.210	48.3	27.3
			0.870	34.4	21.7
			1.416	34.7	22.2
			1.788	36.4	24.5
			2.166	33.5	22.4
			3.330	40.1	32.0
26	0	L	0.210	46.5	29.9
			0.336	39.3	30.0
			2.988	36.1	30.1
		N	0.222	46.6	34.1
			2.550	35.2	26.6
			2.886	36.4	29.3
50	1	L	0.216	44.3	24.0
			2.628	36.0	25.7
			2.946	37.9	29.1
		N	0.228	46.8	34.5
			0.372	36.9	15.9
			3.036	37.0	29.2

Limit of section 15.207:

Frequency of emission (MHz)	QP Limit (dB μ V)	AV Limit (dB μ V/m)
0.15 – 0.5	66 – 56*	56 – 46*
0.5 – 5	56	46
5 – 30	60	50

* Decreases with the logarithm of the frequency.