

EMC TEST REPORT

Report No. : EME-050301

Model No. : WL921

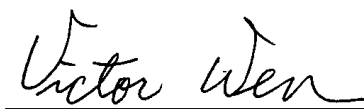
Issued Date : Apr. 14, 2005

Applicant : Kupoint Electric Factory
Juqi Village, Humen, Dongguan, Guangdong, China

Test By : Intertek Testing Services Taiwan Ltd.
No. 11, Ko-Tze-Nan Chia-Tung Li, Shiang-Shan District,
Hsinchu, Taiwan

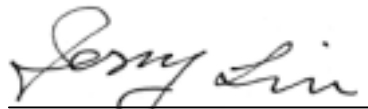
This test report consists of 18 pages in total. It may be duplicated completely for legal use with the allowance of the applicant. It shall not be reproduced except in full, without the written approval of Intertek Laboratory. The test result(s) in this report only applies to the tested sample(s).

Project Engineer



Victor Wen

Reviewed By



Jerry Liu

Table of Contents

Summary of Tests	3
1. General information.....	4
1.1 Identification of the EUT	4
1.2 Additional information about the EUT	4
1.3 Antenna description	5
2. Test specifications.....	6
2.1 Test standard	6
2.2 Operation mode.....	6
2.3 Test equipment	7
3. Radiated emission test FCC 15.231 (b).....	8
3.1 Operating environment	8
3.2 Test setup & procedure	8
3.3 Radiated emission limit	9
3.3.1 Fundamental and harmonics emission limits.....	9
3.3.2 General radiated emission limit	10
3.4 Calculation of Average Factor	11
3.5 Radiated emission test data FCC 15.231	15
3.5.1 Measurement results: Fundamental and Harmnic Radiated Emission Data.....	15
3.5.2 Measurement results: frequencies equal to or less than 1 GHz	16
3.5.3 Measurement results: frequencies above 1GHz.....	17
3.6 Measured bandwidth FCC 15.231(C).....	18

Summary of Tests**Remote Controller -Model: WL921
FCC ID: SHG-WL21A**

Test	Reference	Results
Radiated Emission test	15.231(b), 15.209	Complies
Measured bandwidth	15.231(c)	Complies

1. General information

1.1 Identification of the EUT

Applicant	: Kupoint Electric Factory
Product	: Remote Controller
Model No.	: WL921
FCC ID.	: SHG-WL21A
Frequency Range	: 315MHz
Channel Number	: Single
Frequency of each channel	: 315MHz
Type of Modulation	: ASK
Power Supply	: 4.5Vdc from Battery
Power Cord	: N/A
Sample Received	: Apr. 7, 2005
Test Date(s)	: Apr. 11, 2005 ~ Apr. 12, 2005

1.2 Additional information about the EUT

The EUT is a Remote Controller.

For more detail features, please refer to User's manual as file name "Installation guide.pdf"

1.3 Antenna description

The EUT uses a permanently connected antenna.

Antenna Gain : 6.30 dBi max

Antenna Type : PCB Printed

Connector Type : N/A

2. Test specifications

2.1 Test standard

The EUT was performed according to the procedures in FCC Part 15 Subpart C Section 15.231.

2.2 Operation mode

After verifying three setups of transmitter, we found the worst case was occurred at setup 2, so the final test was executed under this condition and recorded in this report.

During all of the tests, the EUT was operated in transmitting continuously.

Once the button releasing, the transmission will be stopped within 1 second.

2.3 Test equipment

Equipment	Brand	Frequency range	Model No.	Intertek ID No.	Next Cal. Date
EMI Test Receiver	Rohde & Schwarz	9kHz~2.75GHz	ESCS 30	EC303	04/13/2005
EMI Test Receiver	Rohde & Schwarz	20Hz~26.5GHz	ESMI	EC317	07/14/2005
Spectrum Analyzer	Rohde & Schwarz	9kHz~30GHz	FSP 30	EC353	07/13/2005
Spectrum Analyzer	Rohde & Schwarz	20Hz~40GHz	FSEK 30	EC365	10/18/2005
Horn Antenna	EMCO	1GHz~18GHz	3115	EC338	08/16/2005
Horn Antenna	SCHWARZBECK	14GHz~40GHz	BBHA 9170	EC351	07/08/2005
Bilog Antenna	SCHWARZBECK	25MHz~1.7GHz	VULB 9160	EC368	05/20/2005
Pre-Amplifier	MITEQ	100MHz~26.5GHz	919981	EC373	4/13/2005
Pre-Amplifier	MITEQ	26GHz~40GHz	828825	EC374	1/28/2006
Controller	HDGmbH	N/A	HD 100	EP317-1	N/A
Antenna Tower	HDGmbH	N/A	MA 240	EP317-2	N/A
Turn Table	HDGmbH	N/A	DS 420S	EP317-3	N/A
LISN	Rohde & Schwarz	9KHz~30MHz	ESH3-Z5	EC344	01/14/2006

Note: The above equipments are within the valid calibration period.

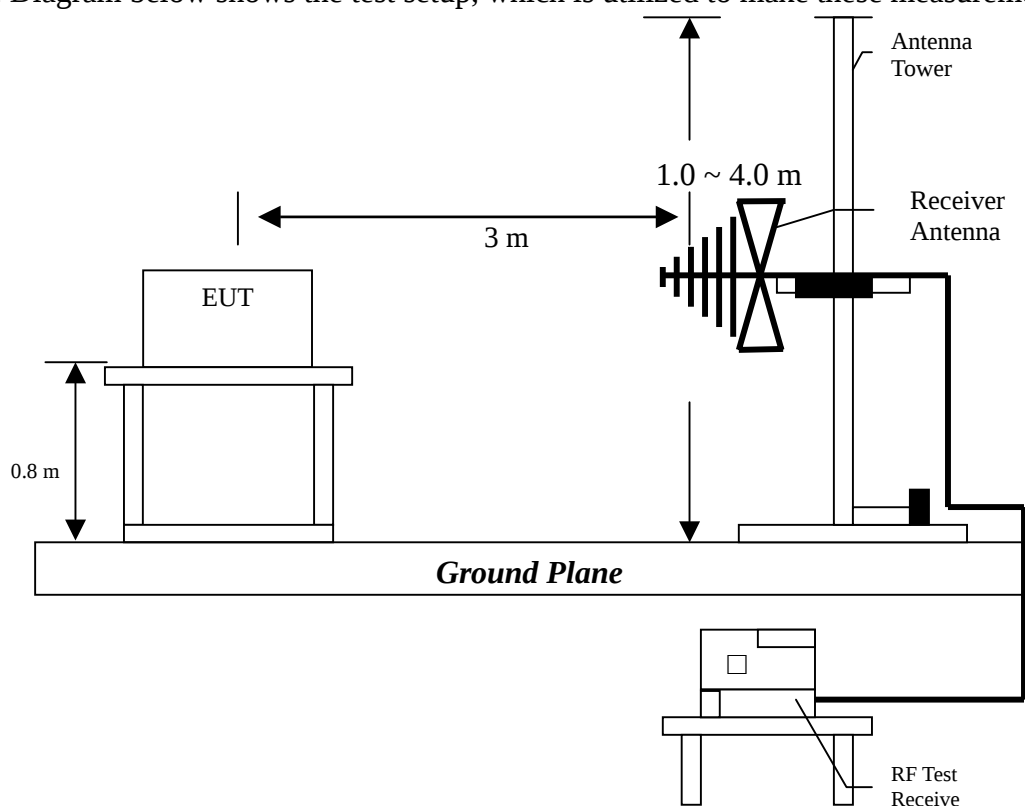
3. Radiated emission test FCC 15.231 (b)

3.1 Operating environment

Temperature: 20
Relative Humidity: 55 %
Atmospheric Pressure 1023 hPa

3.2 Test setup & procedure

The Diagram below shows the test setup, which is utilized to make these measurements.



The signal is maximized through rotation and placement in the three orthogonal axes. Radiated emission measurements were performed from 30MHz to 25GHz. Spectrum Analyzer Resolution Bandwidth is 100kHz or greater for frequencies 30MHz to 1GHz, 1MHz – for frequencies above 1GHz.

The EUT for testing is arranged on a wooden turntable. If some peripherals apply to the EUT, the peripherals will be connected to EUT and the whole system. During the test, all cables were arranged to produce worst-case emissions. The signal is maximized through rotation. The height of antenna and polarization is changing constantly for exploring for maximum signal level. The height of antenna can be up to 4 meters and down to 1 meter.

The measurement for radiated emission will be done at the distance of three meters unless the signal level is too low to measure at that distance. In the case of the reading under noise floor, a pre-amplifier is used and/or the test is conducted at a closer distance. And then all readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance.

The signal is maximized through rotation and placement in the three orthogonal axes.

**Setup 1****Setup 2****Setup 3**

After verifying three axes, we found the maximum electromagnetic field was occurred at setup 2 configuration. The final test data was executed under this configuration.

The EUT configuration please refer to the “Spurious set-up photo.pdf”.

3.3 Radiated emission limit

3.3.1 Fundamental and harmonics emission limits

Frequency (MHz)	Field Strength of Fundamental		Field Strength of Harmonics	
	(uV/m@3m)	(dBuV/m@3m)	(uV/m@3m)	(dBuV/m@3m)
315	6041.68	75.62	604.17	55.62

3.3.2 General radiated emission limit

The spurious Emission shall test through the 10th harmonic. 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).

Frequency MHz	15.209 Limits (dB μ V/m@3m)
30-88	40
88-216	43.5
216-960	46
Above 960	54

Remark:

1. In the above table, the tighter limit applies at the band edges.
2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system

Uncertainty was calculated in accordance with NAMAS NIS 81. Expanded uncertainty (k=2) of radiated emission measurement is ± 3.078 dB.

3.4 Calculation of Average Factor

The specification for output field strengths in accordance with the FCC rules specify measurements with an average detector. During testing, a spectrum analyzer incorporating a peak detector was used. Therefore, a reduction factor can be applied to the resultant peak signal level and compared to the limit for measurement instrumentation incorporating an average detector.

The time period over which the duty cycle is measured in 15.5498377ms or the repetition cycle, whichever is a shorter time frame. The duty cycle is measured by placing the spectrum analyzer in zero span mode at 100KHz resolution bandwidth.

Averaging factor in dB = $20\log(\text{duty cycle})$

The duty cycle is simply the on-time divided by the period:

The duration of one cycle = 15.548377ms

The number of short pulses in each period (16) multiplied by the duration of each short pulses (0.194ms) = 3.117915842ms

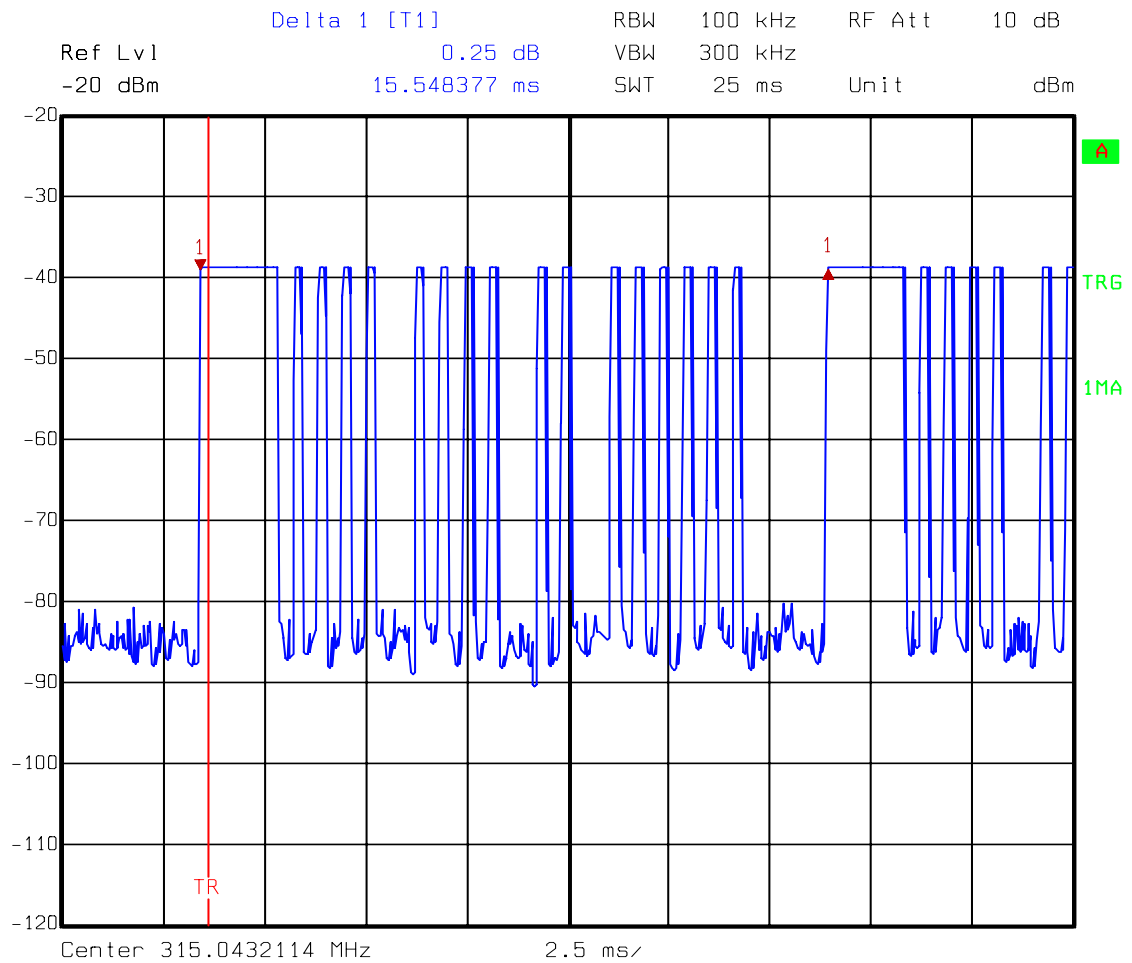
The number of long pulses in each period (1) multiplied by the duration of each long pulses (1.911904ms) = 1.911904ms

Effective period of the cycle = 5.029819842ms

DC = $5.029819842\text{ms} / 15.548377\text{ms} = 0.32$

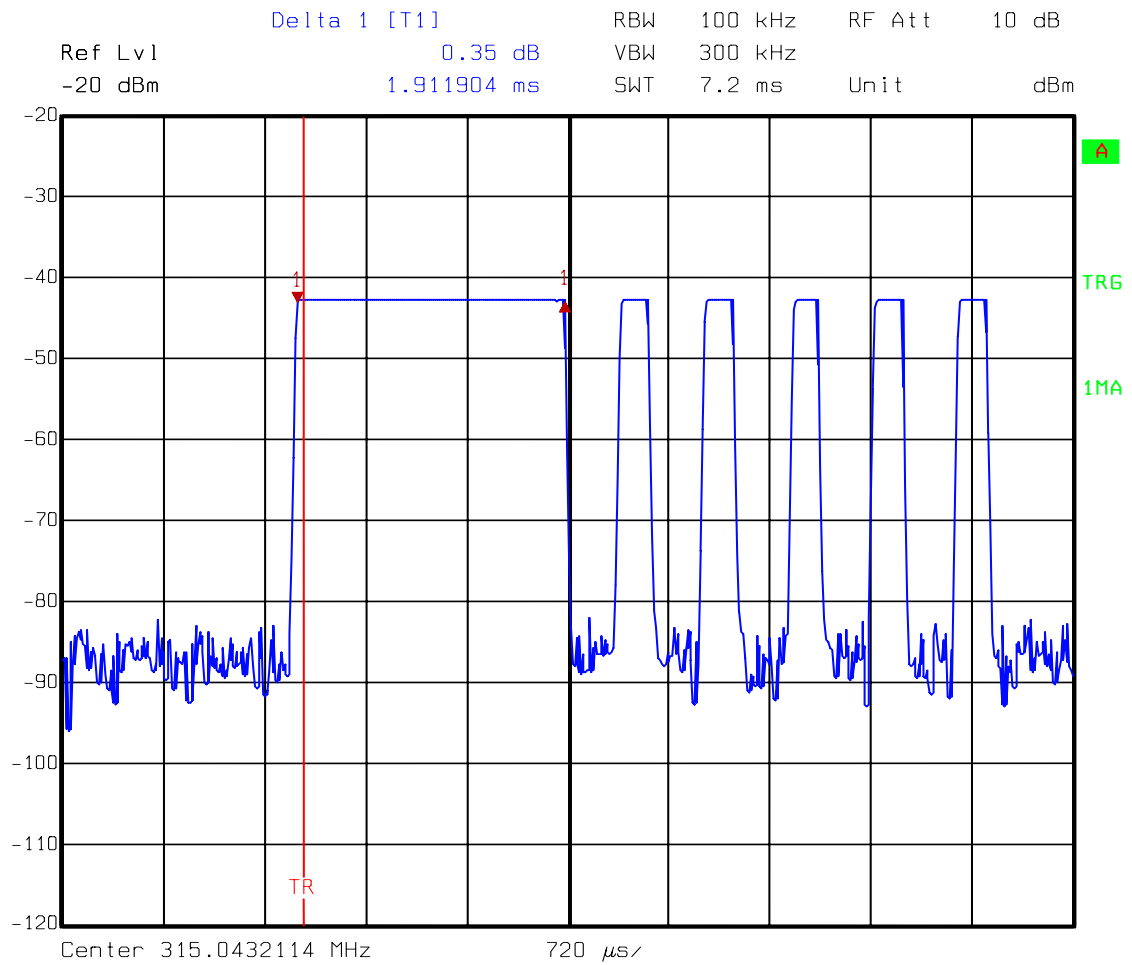
Therefore, the averaging factor is found by $20 \log_{10} 0.3234948472 = -9.802652652\text{dB}$

Please see the plot below.



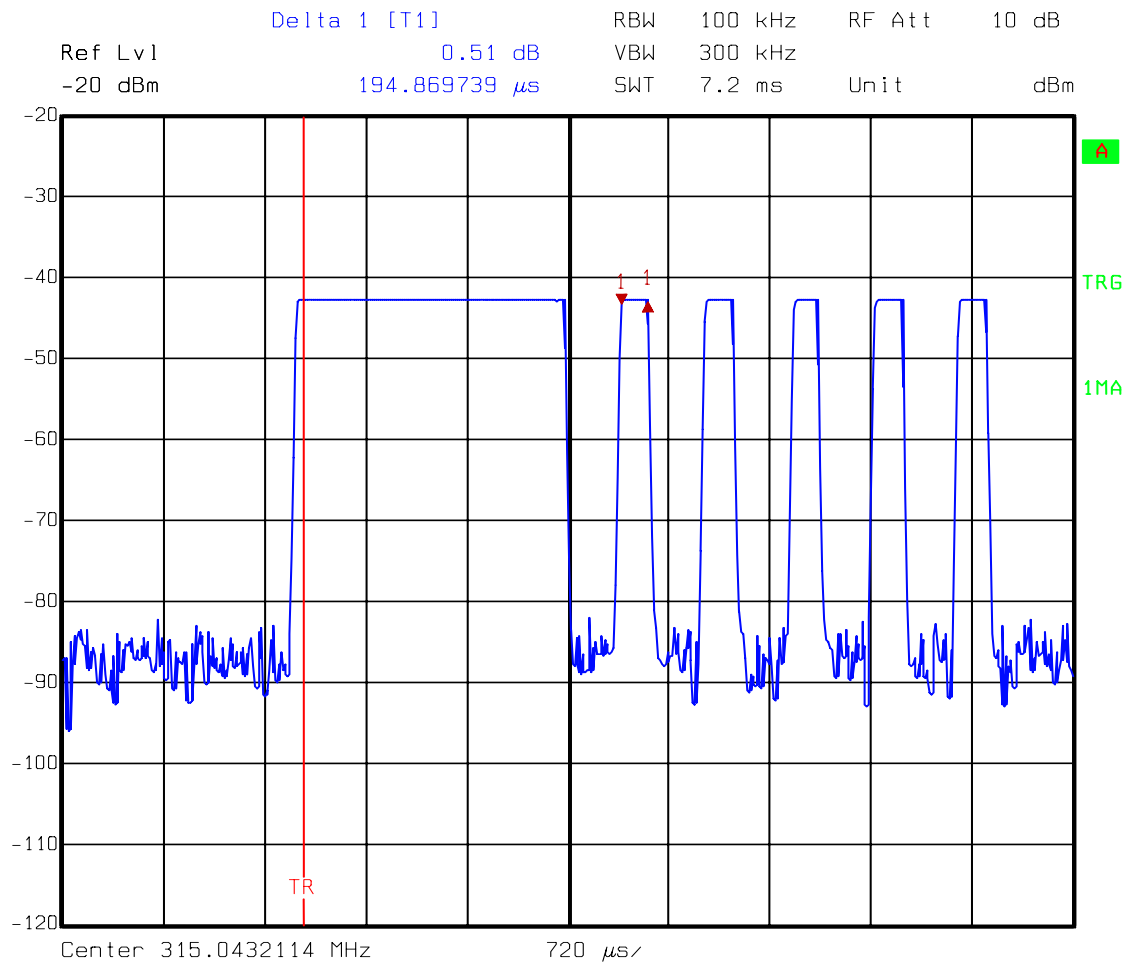
Comment A: ON+OFF

Date: 11.APR.2005 15:56:50



Comment A: ON(1)

Date: 11.APR.2005 16:01:51



Comment A: ON(2)

Date: 11.APR.2005 16:01:23

3.5 Radiated emission test data FCC 15.231

3.5.1 Measurement results: Fundamental and Harmnic Radiated Emission Data

EUT : WL921

Worst Case : Tx at 315MHz with setup 2

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Correction Factor (dB/m)	Reading (dBuV/m)	Average Factor (dB)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)	Antenna high (cm)	Turn Table angle (degree)
315.050	PK	V	12.80	50.08	0	62.88	95.60	-32.72	171	150
315.050	AV	V	12.80	50.08	-9.8	53.08	75.60	-22.52	171	150
630.068	PK	V	18.32	23.17	0	41.49	75.60	-34.11	115	276
630.068	AV	V	18.32	23.17	-9.8	31.69	55.60	-23.91	115	276
945.112	PK	V	22.14	30.80	0	52.94	75.60	-22.66	100	85
945.112	AV	V	22.14	30.80	-9.8	43.14	55.60	-12.46	100	85
315.040	PK	H	12.80	66.06	0	78.86	95.60	-16.74	167	360
315.040	AV	H	12.80	66.06	-9.8	69.06	75.60	-6.54	167	360
630.072	PK	H	18.32	34.95	0	53.27	75.60	-22.33	165	120
630.072	AV	H	18.32	34.95	-9.8	43.47	55.60	-12.13	165	120
945.120	PK	H	22.14	34.11	0	56.25	75.60	-19.35	163	178
945.120	AV	H	22.14	34.11	-9.8	46.45	55.60	-9.15	163	178

Remark:

1. Corrected Level = Correction Factor + Reading + Average Factor
2. Correction Factor = Antenna Factor + Cable Loss
3. Margin = Calculated Level - Limit

3.5.2 Measurement results: frequencies equal to or less than 1 GHz

EUT : WL921

Worst Case : Tx at 315MHz with setup 2

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)	Antenna high (cm)	Turn Table angle (degree)
38.450	QP	V	12.67	12.54	25.21	40.00	-14.79	105	214
67.580	QP	V	13.22	10.57	23.79	40.00	-16.21	112	48
124.370	QP	V	12.89	19.87	32.76	43.50	-10.74	132	245
153.210	QP	V	14.76	12.10	26.86	43.50	-16.64	110	68
168.640	QP	V	14.92	13.87	28.79	43.50	-14.71	114	345
833.970	QP	V	24.26	4.70	28.96	46.00	-17.04	115	350
36.480	QP	H	12.67	15.31	27.98	40.00	-12.02	100	222
154.810	QP	H	14.76	13.40	28.16	43.50	-15.34	131	114
184.350	QP	H	13.55	15.46	29.01	43.50	-14.49	100	122
415.340	QP	H	16.77	10.42	27.19	46.00	-18.81	105	181
664.250	QP	H	21.38	8.45	29.83	46.00	-16.17	113	46
805.620	QP	H	24.29	5.78	30.07	46.00	-15.93	125	331

Remark:

1. Corrected Level = Reading + Correction Factor

2. Correction Factor = Antenna Factor + Cable Loss

3.5.3 Measurement results: frequencies above 1GHz

EUT : WL921

Worst Case : Tx at 315MHz with setup 2

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)	Antenna high (cm)	Turn Table angle (degree)
1260.160	PK	V	27.33	40.06	67.39	74	-6.61	102	130
1260.160	AV	V	27.33	21.24	48.57	54	-5.43	102	130
1575.130	PK	V	28.76	27.54	56.30	74	-17.7	100	110
1575.130	AV	V	28.76	15.56	44.32	54	-9.68	100	110
2520.600	PK	V	32.55	26.42	58.97	74	-15.03	129	230
2520.600	AV	V	32.55	13.71	46.26	54	-7.74	129	230
2835.240	PK	V	32.55	34.68	67.23	74	-6.77	100	250
2835.240	AV	V	32.55	15.99	48.54	54	-5.46	100	250
1260.200	PK	H	27.33	39.67	67.00	74	-7.00	130	185
1260.200	AV	H	27.33	18.91	46.24	54	-7.76	130	185
1575.200	PK	H	28.76	27.99	56.75	74	-17.25	100	360
1575.200	AV	H	28.76	15.98	44.74	54	-9.26	100	360
2835.380	PK	H	32.55	32.7	65.25	74	-8.75	129	190
2835.380	AV	H	32.55	14.69	47.24	54	-6.76	129	190

Remark:

1. Corrected Level = Reading + Correction Factor
2. Correction Factor = Antenna Factor + Cable Loss
3. “*” means the emission within the restricted band meets the requirement of part 15.205. The corresponding limit as per 15.209.

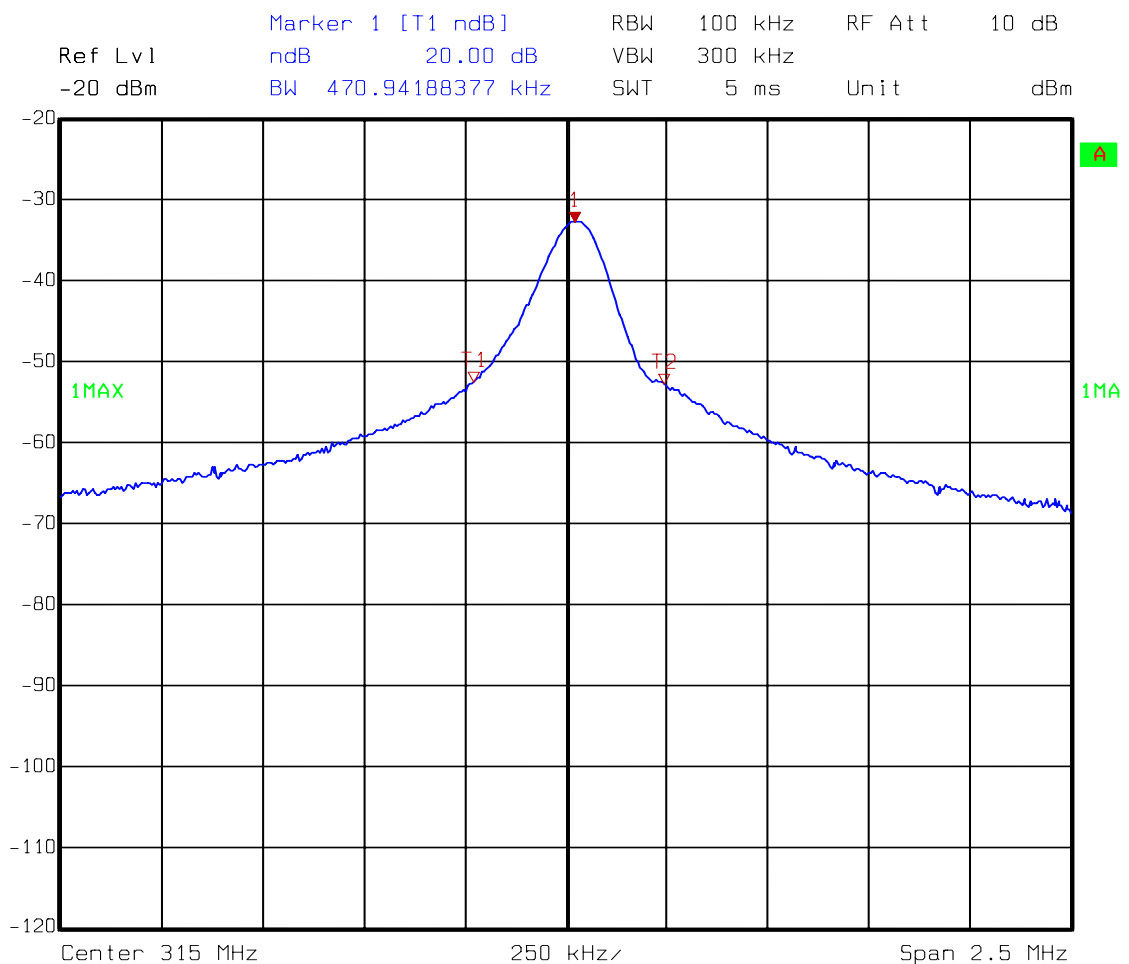
3.6 Measured bandwidth FCC 15.231(C)

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70MHz and below 900MHz. Bandwidth is determined at the points 20dB down from the modulated carrier.

$$B.W(20dBc) \text{ Limit} = 0.25\% \times f(\text{MHz}) = 0.25\% \times 315\text{MHz} = 0.7875\text{MHz}$$

From the plot, the bandwidth is observed to be 315MHz, at 20dBc where the bandwidth limit is 0.7875MHz.

Please see the plot below.



Comment A: 20dB BW

Date: 11.APR.2005 16:19:25