EMC
TEST REPORT

Report No. : TS09120091-EME
Model No. : R9P005
Issued Date : Feb. 10, 2010

Applicant: **Powertech Industrial Co., Ltd.**
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Test Method/ Standard: **47 CFR FCC Part 15.231 & ANSI C63.4 2003**

Test By: **Intertek Testing Services Taiwan Ltd.**
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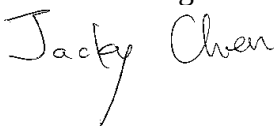

Name Jacky Chen
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Summary of Tests

Wireless Home Appliance Remote Control Kit - Model: R9P005
FCC ID: NHS-R9P005

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

1. General information

1.1 Identification of the EUT

Product:	Wireless Home Appliance Remote Control Kit
Model No.:	R9P005
FCC ID.:	NHS-R9P005
Frequency Range:	433.92 MHz
Channel Number:	Single channel
Frequency of Each Channel:	433.92 MHz
Type of Modulation:	ASK
Power Supply:	DC 12 V from battery
Power Cord:	N/A
Sample Received:	Dec. 28, 2009
Test Date(s):	Feb. 08, 2010 ~ Feb. 09, 2010
Note 1:	This report is for the exclusive use of Intertek's Client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to permit copying or distribution of this report and then only in its entirety. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. The observations and test results in this report are relevant only to the sample tested. This report by itself does not imply that the material, product, or service is or has ever been under an Intertek certification program.
Note 2:	When determining the test conclusion, the Measurement Uncertainty of test has been considered.

1.2 Additional information about the EUT

The EUT is a Wireless Home Appliance Remote Control Kit and transmitted by manual setting. The transmission will stop once released the switch and was defined as information technology equipment.

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	: -20 dBi max
Antenna Type	: PCB printed antenna
Connector Type	: N/A

2. Test specifications

2.1 Test standard

The EUT was performed according to the procedures in FCC Part 2.1053 and the requirement in FCC Part 15 Subpart C Section 15.231.

2.2 Operation mode

The EUT was transmitted continuously during the test.

2.3 Test equipment

Equipment	Brand	Frequency range	Model No.
EMI Test Receiver	Rohde & Schwarz	9 kHz~2.75 GHz	ESCS 30
Spectrum Analyzer	Rohde & Schwarz	9 kHz~30 GHz	FSP 30
Spectrum Analyzer	Rohde & Schwarz	20 Hz~40 GHz	FSEK 30
Horn Antenna	EMCO	1 GHz~18 GHz	3115
Horn Antenna	SCHWARZBECK	14 GHz~40 GHz	BBHA 9170
Bilog Antenna	SCHWARZBECK	25 MHz~1.7 GHz	VULB 9160
Pre-Amplifier	MITEQ	100 MHz~26.5 GHz	919981
Pre-Amplifier	MITEQ	26 GHz~40 GHz	828825
Controller	HDGmbH	N/A	HD 100
Antenna Tower	HDGmbH	N/A	MA 240
Turn Table	HDGmbH	N/A	DS 420S
LISN	Rohde & Schwarz	9 kHz~30 MHz	ESH3-Z5

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

3. Radiated emission test FCC 15.231 (b)

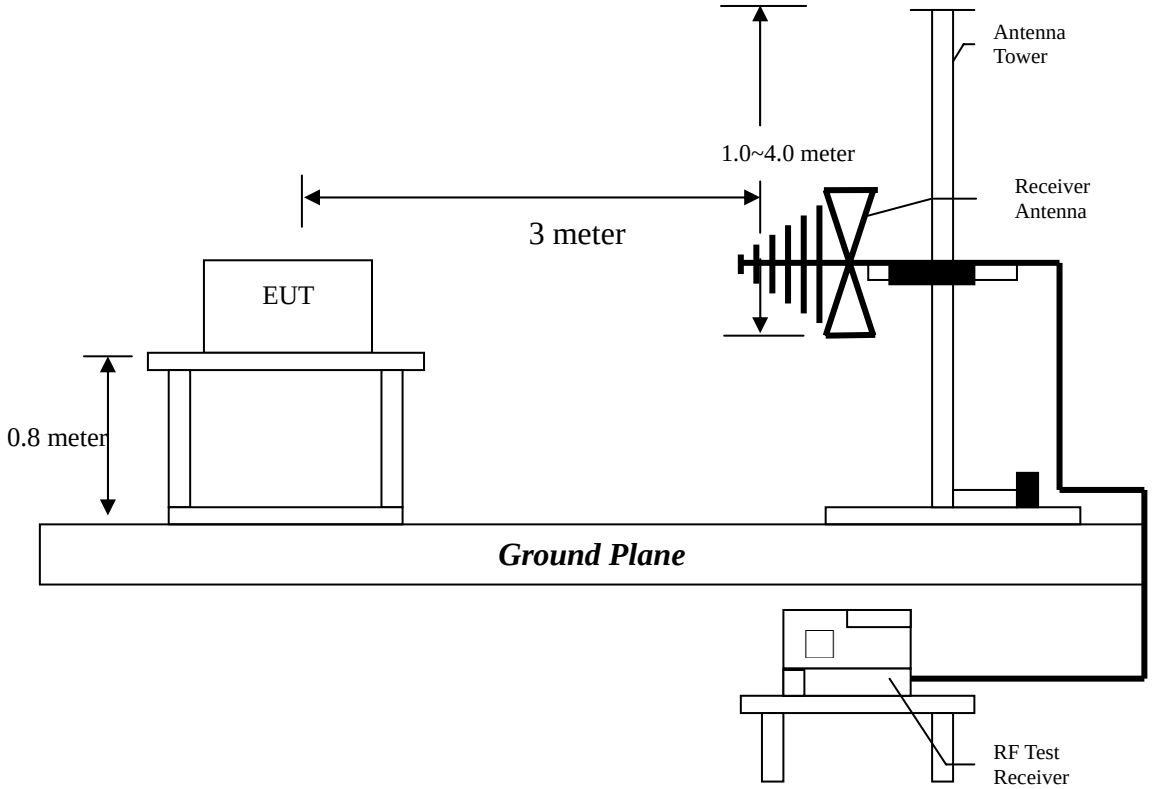
3.1 Operating environment

Temperature:	24	℃
Relative Humidity:	55	%
Atmospheric Pressure	1023	hPa

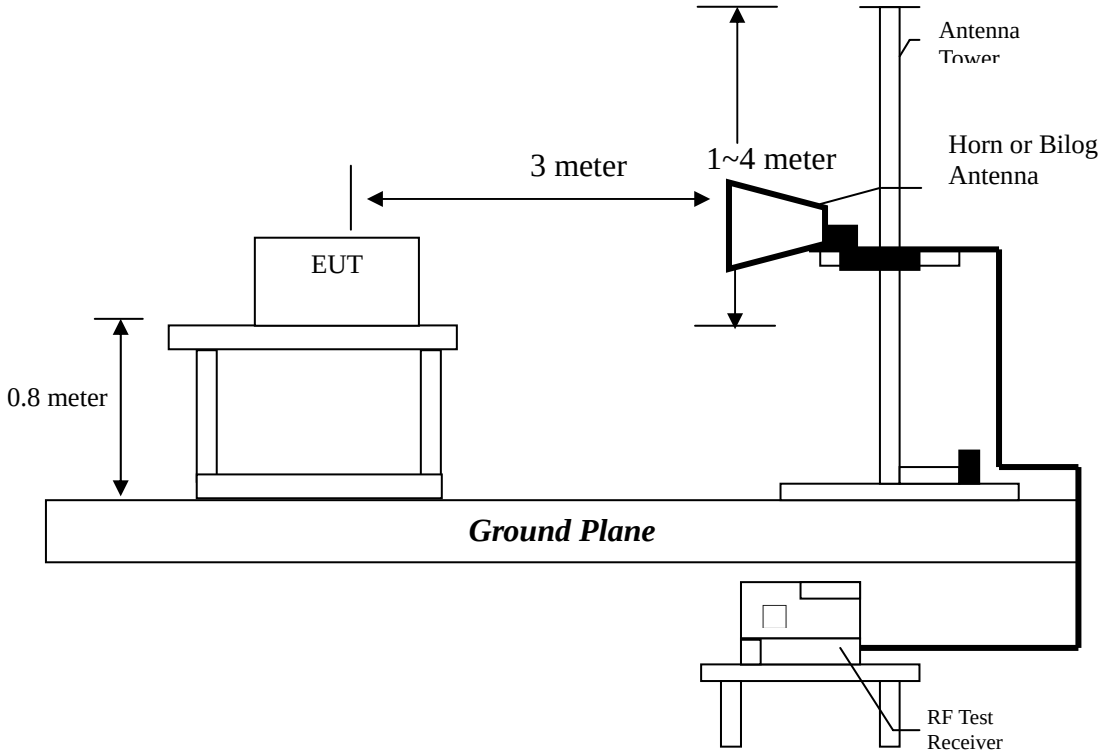
3.2 Test setup & procedure

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

The frequency spectrum from 30MHz to 1000MHz was investigated.



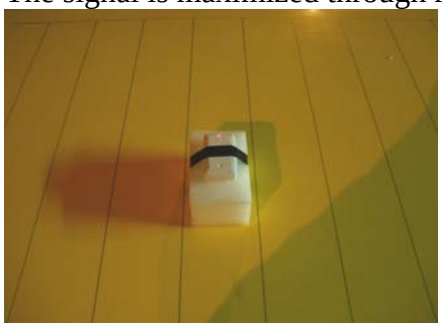
The frequency spectrum from over 1GHz was investigated.



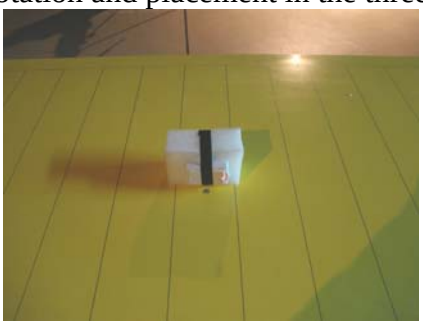
The signal is maximized through rotation and placement in the three orthogonal axes. Radiated emission measurements were performed from 30 MHz to 25 GHz. Spectrum Analyzer Resolution Bandwidth is 100 kHz or greater for frequencies 30 MHz to 1 GHz, 1MHz – for frequencies above 1 GHz.
The EUT for testing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

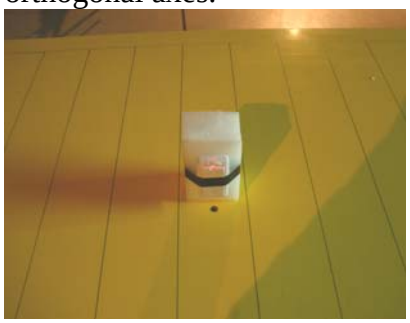
The signal is maximized through rotation and placement in the three orthogonal axes.



X axis



Y axis



Z axis

After verifying three axes, we found the maximum electromagnetic field was occurred at Z axis. 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@3 m)	(dBuV/m@3 m)	(uV/m@3 m)	(dBuV/m@3 m)
433.92	10958	80.8	1096.5	60.8

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

Measurement uncertainty was calculated in accordance with TR 100 028-1.

Parameter	Uncertainty
Radiated Emission	±5.056 dB
Conducted Emission	±2.786 dB

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

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 100 ms 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 100 resolution bandwidth.

Averaging factor in dB = 20log (duty cycle)

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

The duration of one cycle = 43.6 ms

The number of short pulses in each period (13) multiplied by the duration of each short pulses(1.02 ms)= 13.26 ms

The number of long pulses in each period (12) multiplied by the duration of each long pulses(0.332 ms)= 3.984 ms

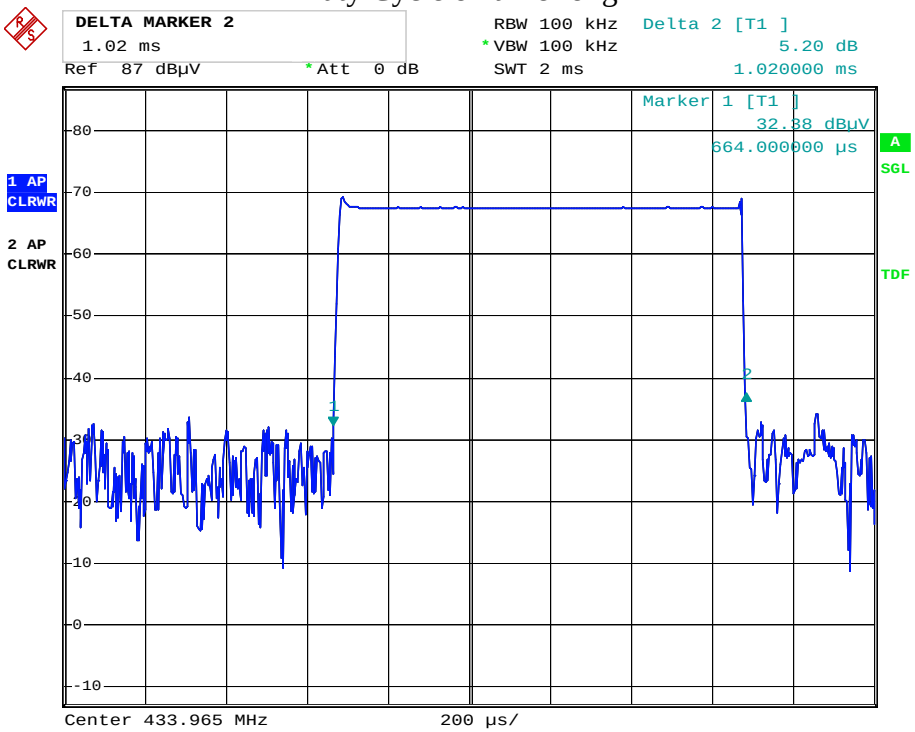
Effective period of the cycle= 13.26+3.984=17.224 ms

Duty Cycle = 17.224 ms/ 43.6 ms = 0.395

Therefore, the duty cycle correction factor will be $20 \log_{10} 0.395 = -8.07$ dB

Please see the plot below.

Duty Cycle on time-long



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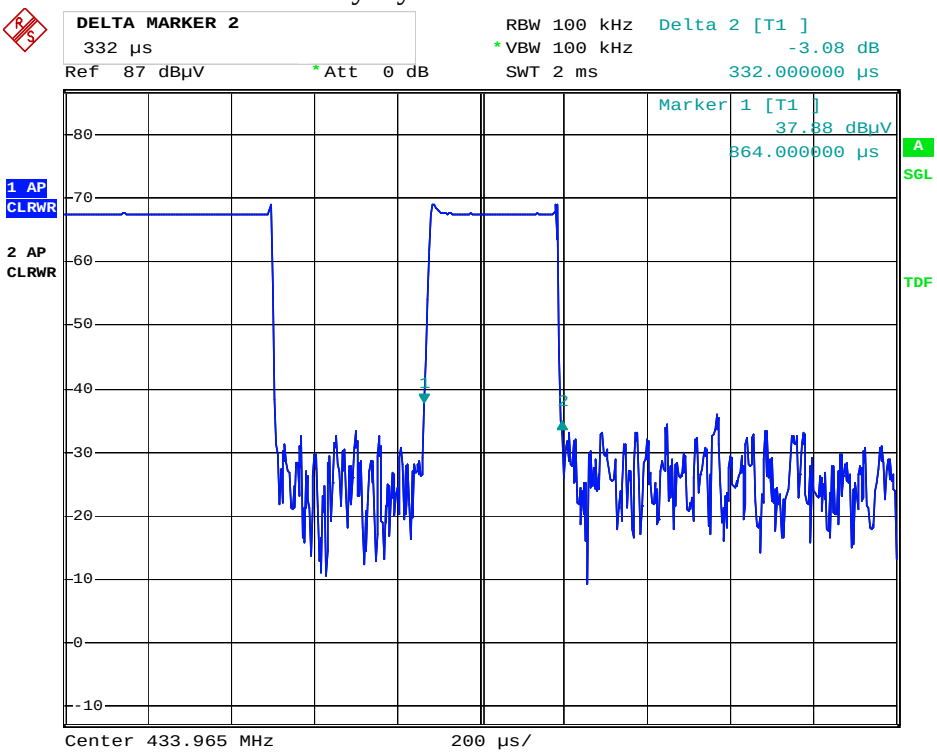
Duty Cycle on time-Short



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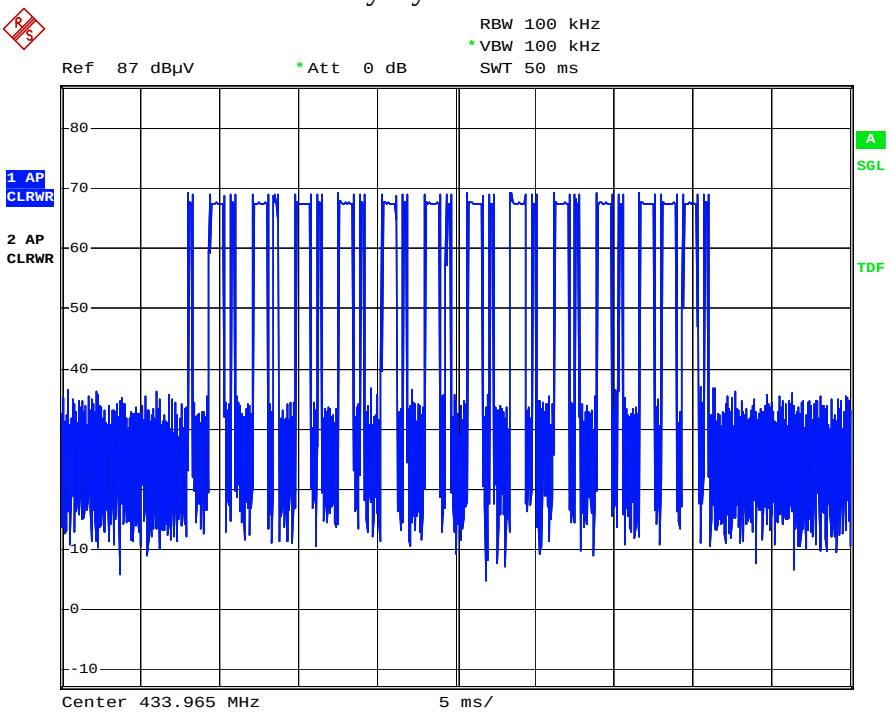
Duty Cycle on-time



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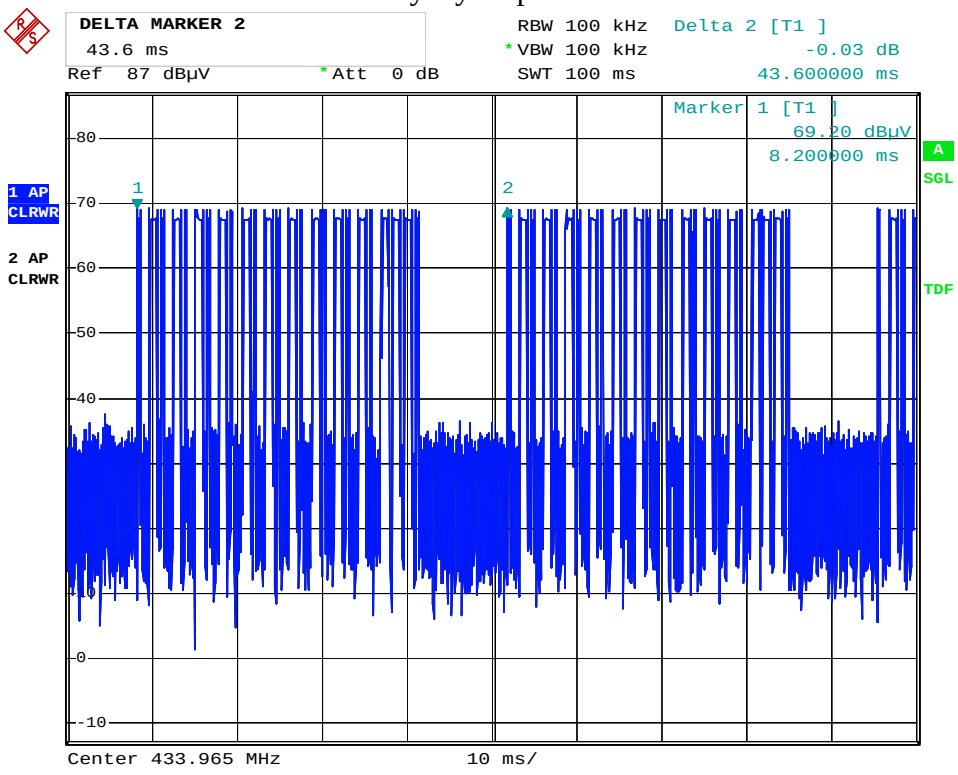
Duty Cycle period



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3.5 Radiated emission test data FCC 15.231

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

EUT : R9P005
Worst Case : Tx at 433.92 MHz in Z axis

Fundamental

Polarization (circle)	Frequency (MHz)	Detector	Corr. Factor (dB/m)	Reading (dBuV)	Calculated dBuV/m	Limit (dBuV/m)	Margin (dB)
Vertical	433.92	QP	19.42	59.41	78.84	80.828	-1.99
Vertical	868.08	QP	26.48	16.37	42.85	60.828	-17.98
Horizontal	433.92	QP	19.42	48.12	67.55	80.828	-13.28
Horizontal	868.08	QP	26.48	13.56	40.04	60.828	-20.79

Remark:
1. Calculated = Reading + Corr. Factor
2. Correction Factor = Antenna Factor + Cable Loss
3. Margin= Calculated - Limit

3.5.2 Measurement results: frequencies above 1GHz

EUT : R9P005
Worst Case : Tx at 433.92 MHz in Z axis

Polarization (circle)	Frequency (MHz)	Detector	Corr. Factor (dB/m)	Reading (dBuV)	Average Factor (dB)	Calculated dBuV/m	Limit (dBuV/m)	Margin (dB)
Vertical	1302.00	PK	29.28	24.17	0.00	53.45	74.000	-20.55
Vertical	1302.00	AV	29.28	24.17	-8.07	45.38	54.000	-8.62
Vertical	1736.00	PK	30.62	23.27	0.00	53.89	80.828	-26.94
Vertical	1736.00	AV	30.62	23.27	-8.07	45.82	60.828	-15.01
Vertical	2170.00	PK	31.90	24.80	0.00	56.70	80.828	-24.13
Vertical	2170.00	AV	31.90	24.80	-8.07	48.63	60.828	-12.20
Horizontal	1302.00	PK	29.28	23.71	0.00	52.99	74.000	-21.01
Horizontal	1302.00	AV	29.28	23.71	-8.07	44.92	54.000	-9.08
Horizontal	1736.00	PK	30.62	24.17	0.00	54.79	80.828	-26.04
Horizontal	1736.00	AV	30.62	24.17	-8.07	46.72	60.828	-14.11
Horizontal	2170.00	PK	31.90	24.00	0.00	55.90	80.828	-24.93
Horizontal	2170.00	AV	31.90	24.00	-8.07	47.83	60.828	-13.00

Remark:
1. Calculated = Reading + Corr. Factor – Average Factor
2. Correction Factor = Antenna Factor + Cable Loss
3. Margin= Calculated - Limit

4. 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) Limit = 0.25% × f(MHz) = 0.25% × 433.92 MHz = 1.0848 MHz

From the plot, the bandwidth is observed to be 433.92 MHz, at 20dBc where the bandwidth limit is 1.0848 MHz.

Please see the plot below.