No. 1116

Electromagnetic Compatibility

Test of:	Gas Fire remote controller
FCC ID :	XO5RXR9400-6000E
Applicant:	SMK (UK) LTD
Test Type:	Compliance
Test Specification:	FCC CFR47, parts 2.1049, 15.249
SGS Serial Number:	EMC127535B\1\CL\09
Date of Receipt:	25th June 2009
Date of Test(s):	26th August 2009 to 3rd September 2009
Date of Issue:	26th October 2009
Issue Number:	2

A. H. Reynard

Authorised Signatory

A. Reynard
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1. Client Information

Company Name:	SMK (UK) LTD
Address:	Northfield Way Aycliffe Ind. Estate Newton Aycliffe Co. Durham DL5 6UF
Contact Person:	David Wishart
Telephone:	01325 300770
Facsimile:	01325 300556

2. Details Of Test Laboratory

Company Name:	SGS UK Ltd.
UKAS Accreditation Number:	1116
Address:	South Industrial Estate, Bowburn, Co. Durham, DH6 5AD.
Contact Persons:	Mr Stephen Thompson
Telephone:	+44 191 377 2000
Facsimile:	+44 191 377 2020

3. Equipment Under Test (EUT)

3.1 Identification Of EUT

FCC ID:	XO5RXR9400-6000E
Unique Identifier:	Not Supplied
Description of EUT:	The equipment under test is a radio controlled gas fire controller
Highest Internal Clock Frequencies:	2.47GHz
Supply Voltage:	4.5V (3X1.5V battery)
Ports present:	Enclosure
Accessories Supplied:	Transmitter

4. Test Specification, Methods and Procedures

4.1 Test Specification(s)

Specification(s)	Title
FCC CFR 47 : October 2008 Parts 2.1049, 15.249	Code Of Federal Regulations part 15 Telecommunication – Radio frequency devices

4.2 Purpose Of Test

To perform the relevant tests and assess the product for compliance with the above specification (s).

4.3 Methods and Procedures

The standards listed on the previous page refer to the following tests: -

CFR 47 Clause	Test
15.249	Radiated Emissions
15.249	Frequency Tolerance under extreme temperatures
15.249	Frequency Tolerance under extreme voltages
2.1049	Occupied Bandwidth

The tests were conducted in accordance with the following specification:

ANSI C63.4:2003 : American National Standards for Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range 9 kHz to 40 GHz.

5. Deviations or Exclusions from the Test Specifications

There were no deviations from the test specifications.

6. Operation of the EUT During Testing / Configuration and Peripherals

6.1 Operation of EUT during testing.

The equipment under test periodically handshakes with the transmitter every second as per normal operation. The EUT cannot transmit at a rate greater the once per second.

6.2 Configuration and Peripherals

The EUT consists of the control unit, igniter and solenoid which were all connected during testing. In normal use the control unit is connected to 4.5 V battery however for test purposes a 4.5 V DC supply was connected instead. The companion transmitter was placed nearby in order to verify the communication link.

7. Test Results

7.1 General Comments

The test methods used are referred to in the individual test results sections of this test report.

7.2 Modifications Made to the EUT

No modifications were made to the EUT during the testing.

7.3 Summary of Test Results

CFR 47 Clause	Test	Result
15.249	Radiated Emissions	Complied
15.249	Frequency Tolerance under extreme temperatures	Complied
15.249	Frequency Tolerance under extreme voltages	Complied
2.1049	Occupied Bandwidth	Complied

Result

In the configuration tested, the EUT complies with the requirements of Clauses of CFR 47 : Part 15.

Full details of all tests can be found in the test results section of this report.

7.4 Radiated Emissions Test Results 15.249

CFR Clause	15.249
Frequency Range	9 kHz – 25GHz

Test Results

Frequency Range 0.009MHz – 30MHz

The Frequency Range was investigated and no emissions above the instrument noise floor could be attributed to the EUT. The investigation was performed with an EUT to loop distance of 1m.

Frequency Range 30 - 1000MHz

Frequency	Measurement S.A Quasi-peak (dBuV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-Amplifier Gain (dB)	Quasi-Peak Measurement (dBuV/m)	Quasi-Peak Limit (dBuV)	Antenna Polarity
50.563	29.00	1.4	10.7	29.9	11.2	40.0	Horizontal
77.500	28.67	2.4	7.03	29.7	8.4	40.0	Horizontal
119.987	25.94	2.4	14.86	29.7	13.5	43.5	Horizontal
149.927	25.02	3.3	16.08	29.7	14.7	43.5	Horizontal
276.717	24.72	4.7	19.48	29.7	19.2	46.0	Horizontal
450.057	24.10	6.8	16.6	30.0	17.5	46.0	Horizontal
50.623	29.5	1.4	10.7	29.9	11.7	40.0	Vertical
77.500	29.17	2.4	7.03	29.7	8.9	40.0	Vertical
120.047	26.24	2.4	14.86	29.7	13.8	43.5	Vertical
149.974	25.22	3.3	16.08	29.7	14.9	43.5	Vertical
277.819	23.94	4.7	20.16	29.7	19.1	46.0	Vertical
450.149	24.10	6.8	16.6	30.0	17.5	46.0	Vertical

The above measurements were made at 3m with a 120 kHz resolution bandwidth.

Note: The limits given are the general radiated emission limits specified in 15.209.

15.249 d) *"Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50dB below the level of the fundamental or to the general radiated emission limits in 15.209, whichever is the lesser attenuation."*

Frequency Range 1000 – 4000MHz

Peak Measurements

Frequency (GHz)	Spectrum Analyser (dBuV)	Antenna factor (dB/m)	Atten. (dB)	Cable loss (dB)	Pre-amplifier Gain (dB)	Field Strength 1m (dBuV/m)	Field strength 3m* (dBuV/m)	Antenna Polarity	Limit** (dBuV/m) Average	Limit (dBuV/m) Peak
2.415	83.68	28.75	6	4.96	37.51	85.88	75.88	Vertical	93.98	103.98
4.83	44.29	33.89	6	6.94	36.41	54.71	44.71	Vertical	53.98	73.98
7.245	46.12	37.27	6	8.75	36.25	61.89	51.89	Vertical	53.98	73.98
9.660	45.32	38.23	6	9.91	37.04	62.42	52.42	Vertical	53.98	73.98
12.075	45.50	38.95	6	11.74	35.97	66.22	56.22	Vertical	53.98	73.98
14.490	49.58	38.46	6	11.27	34.44	70.87	60.87	Vertical	53.98	73.98
16.905	49.53	45.59	0	12.82	34.61	73.33	63.33	Vertical	53.98	73.98
19.320	51.65	40.7	0	13.15	34.17	71.33	61.33	Vertical	53.98	73.98
21.735	52.37	40.9	0	12.54	34.25	71.56	61.56	Vertical	53.98	73.98
24.150	52.51	41.3	0	12.44	32.64	73.61	63.61	Vertical	53.98	73.98
2.415	94.34	28.75	6	4.96	96.54	96.54	86.54	Horiz.	93.98	103.98
4.830	51.66	33.89	6	6.94	62.08	62.08	52.08	Horiz.	53.98	73.98
7.245	48.89	37.27	6	8.75	64.66	64.66	54.66	Horiz.	53.98	73.98
9.660	47.11	38.23	6	9.91	64.21	64.21	54.21	Horiz.	53.98	73.98
12.075	46.07	38.95	6	11.74	66.79	66.79	56.79	Horiz.	53.98	73.98
14.490	51.97	38.45	6	11.27	73.26	73.26	63.26	Horiz.	53.98	73.98
16.905	51.17	45.59	0	12.82	74.97	74.97	64.97	Horiz.	53.98	73.98
19.320	51.95	40.7	0	13.15	71.63	71.63	61.63	Horiz.	53.98	73.98
21.735	53.5	40.9	0	12.54	72.63	72.69	62.69	Horiz.	53.98	73.98
24.150	53.83	41.3	0	12.44	74.93	74.93	64.93	Horiz.	53.98	73.98

* The above measurements were made at 1m. The Measurement was corrected using the square of an inverse linear distance extrapolation factor (20dB/decade). See 15.31 f) 2) This results in an extrapolation factor of 10dB between 1 and 3m.

** 902-928MHz Fundamental 50mV/meter (93.98dBuV/m), Harmonics 500uV/m (53.98dBuV/m).

15. 249 e) "The peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation."

The above measurements were made with a 1 MHz resolution bandwidth.

Average Measurements

Frequency (GHz)	Spectrum Analyser (dBuV)	Antenna factor (dB/m)	Atten. (dB)	Cable loss (dB)	Pre-amplifier Gain (dB)	Field Strength 1m (dBuV/m)	Field strength 3m* (dBuV/m)	Antenna Polarity	Limit** (dBuV/m) Average
2.415	33.62	28.75	6	4.96	37.51	35.82	25.82	Horiz.	93.98
4.83	32.07	33.89	6	6.94	36.41	42.49	32.49	Horiz.	53.98
7.245	32.18	37.27	6	8.75	36.25	47.95	37.95	Horiz.	53.98
9.66	33.00	38.23	6	9.91	37.04	50.1	40.1	Horiz.	53.98
12.075	32.3	38.95	6	11.74	35.97	53.02	43.02	Horiz.	53.98
14.49	38.8	38.46	6	11.27	34.44	60.09	50.09	Horiz.	53.98
16.905	38.5	45.59	0	12.82	34.61	62.3	52.3	Horiz.	53.98
19.32	38.32	40.7	0	13.15	34.17	58.0	48.0	Horiz.	53.98
21.735	40.02	40.9	0	12.54	34.25	59.21	49.21	Horiz.	53.98
24.15	39.92	41.3	0	12.44	32.64	61.02	51.02	Horiz.	53.98
2.415	33.74	28.75	6	4.96	37.51	35.94	25.94	Vertical	93.98
4.83	32.4	33.89	6	6.94	36.41	42.82	32.82	Vertical	53.98
7.245	32.2	37.27	6	8.75	36.25	47.97	37.97	Vertical	53.98
9.66	33.5	38.23	6	9.91	37.04	50.6	40.6	Vertical	53.98
12.075	32.8	38.95	6	11.74	35.97	53.52	43.52	Vertical	53.98
14.49	38.08	38.46	6	11.27	34.44	59.37	49.37	Vertical	53.98
16.905	38.42	45.59	0	12.82	34.61	62.22	52.22	Vertical	53.98
19.32	39.7	40.7	0	13.15	34.17	59.38	49.38	Vertical	53.98
21.735	39.95	40.9	0	12.54	34.25	59.14	49.14	Vertical	53.98
24.15	40.08	41.3	0	12.44	32.64	61.18	51.18	Vertical	53.98

* The above measurements were made at 1m. The Measurement was corrected using the square of an inverse linear distance extrapolation factor (20dB/decade). See 15.31 f) 2) This results in an extrapolation factor of 10dB between 1 and 3m.

** 902-928MHz Fundamental 50mV/meter (93.98dBuV/m), Harmonics 500uV/m (53.98dBuV/m).

15. 249 e) “The peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.”

The above measurements were made with a 1 MHz resolution bandwidth.

Frequency Band Edges – Peak Measurements

Freq (GHz)	Spect Analys Meas-ment dBuV	Rx Att (dB)	Rx ant Factor (dB)	Rx Cable Loss (dB)	Pre-amp Gain (dB)	Field Strength dBuV at 1m	Field Strength dBuV at 3m	Antenna Polarity	Limit** (dBuV/m) Average	Peak Limit dBuV/m
2.4	35.51	6	28.75	4.96	37.51	37.71	27.71	Vert	53.98	73.98
2.4	35.82	6	28.75	4.96	37.51	38.02	28.02	Horiz	53.98	73.98
2.4835	35.08	6	28.75	4.96	37.51	37.28	27.28	Vert	53.98	73.98
2.4835	35.15	6	28.75	4.96	37.51	37.35	27.35	Horiz	53.98	73.98

* The above measurements were made at 1m using a peak detector. The Measurement was corrected using the square of an inverse linear distance extrapolation factor (20dB/decade). See 15.31 f) 2); this results in an extrapolation factor of 10dB between 1 and 3m.

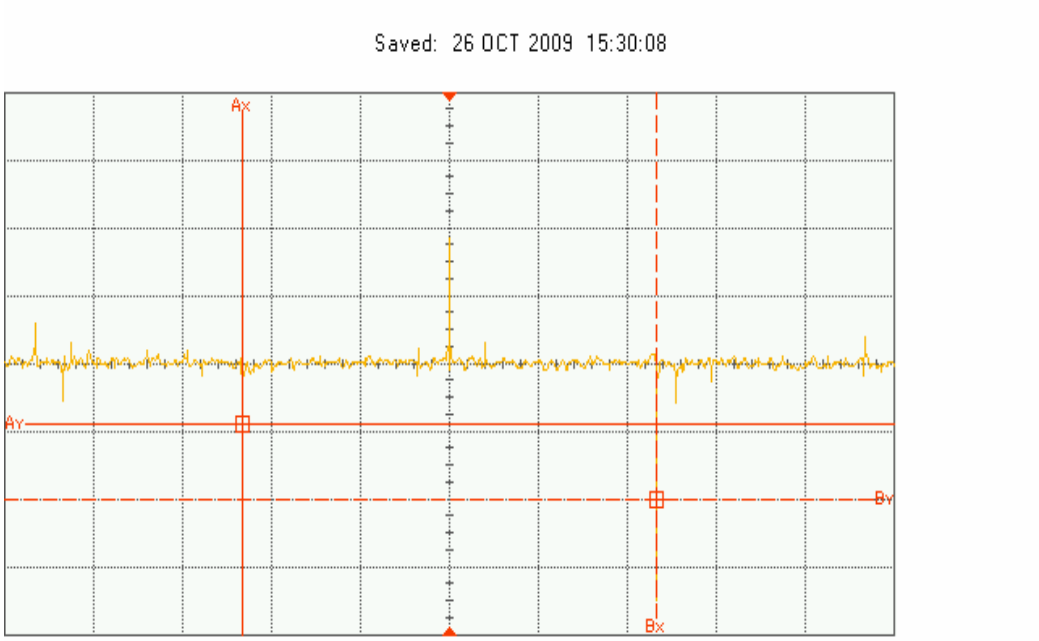
** 2400-2483.5MHz Fundamental 50mV/meter (93.98dBuV/m), Harmonics 500uV/m (53.98dBuV/m).

15. 249 e) "The peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation."

The above measurements were made with a 1MHz resolution bandwidth.

Plot Showing pulse repetition rate exceeds 20Hz

The below plot shows 3 pulses with the markers on the first and third pulses hence the repetition frequency is twice that of 21.4844 Hz i.e. 42.9688 Hz.

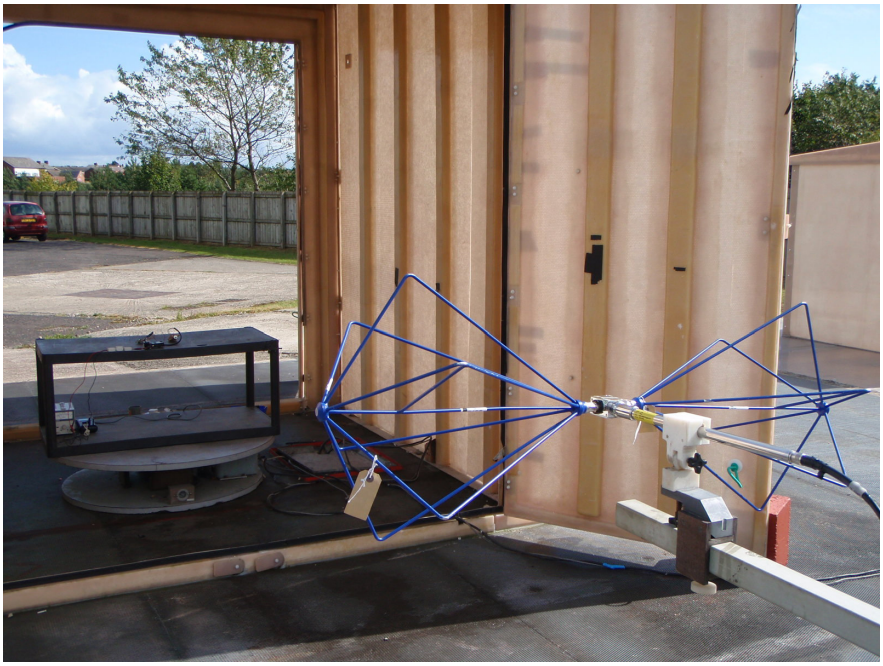


Acquisition	Sampling mode real time Memory depth automatic Memory depth 1004pts Sampling rate automatic Sampling rate 10.0 kSa/s Averaging off 9-bit BW Filter off Interpolation on
Channel 1	Scale 2 mV/div Offset 0.0 V BW limit off Coupling DC Impedance 1M Ohm Attenuation 1.000 : 1 Atten units ratio Skew 0.0 s Ext adaptor None Ext gain 1.00 V Ext offset 0.0 V
Time base	Scale 10.0 ms/div Position 0.0 s Reference center
Trigger	Mode edge Sweep auto Hysteresis normal Holdoff time 60 ns Coupling DC Source channel 1 Trigger level 6.52 mV Slope falling

Marker

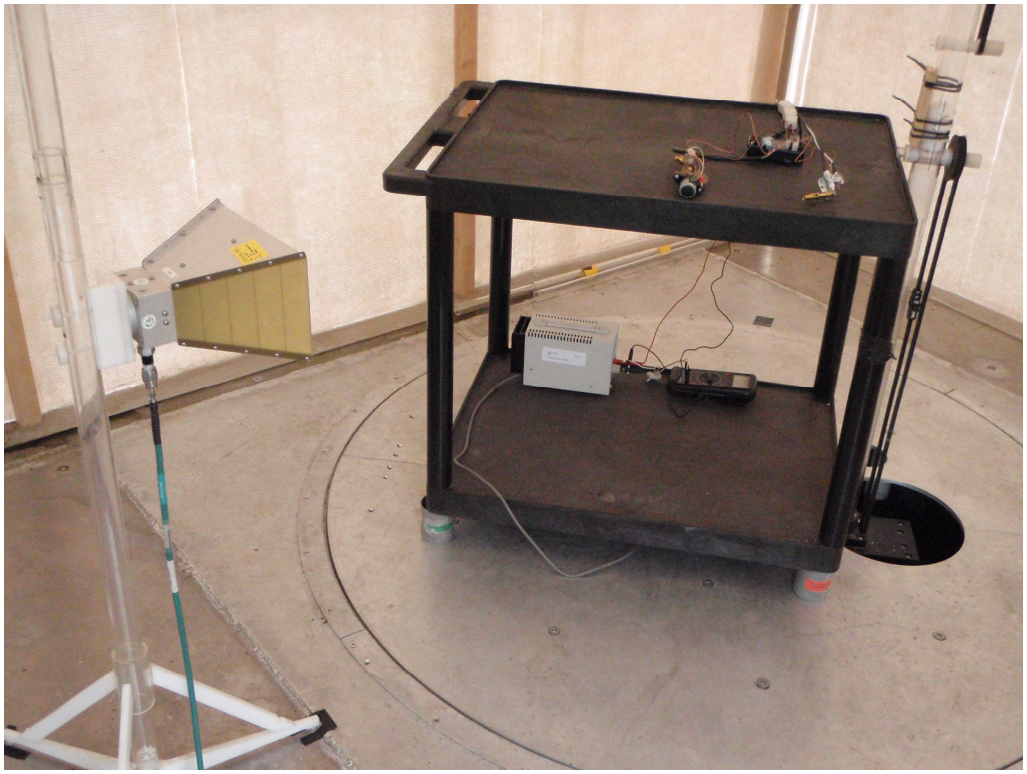
	X	Y
A——(1) =	-23.273 ms	-1.76 mV
B---(1) =	23.273 ms	-4.01 mV
Δ =	46.545 ms	-2.25 mV
1/ΔX =	21.4844 Hz	

Radiated Emissions Test Configuration 30MHz - 1000MHz

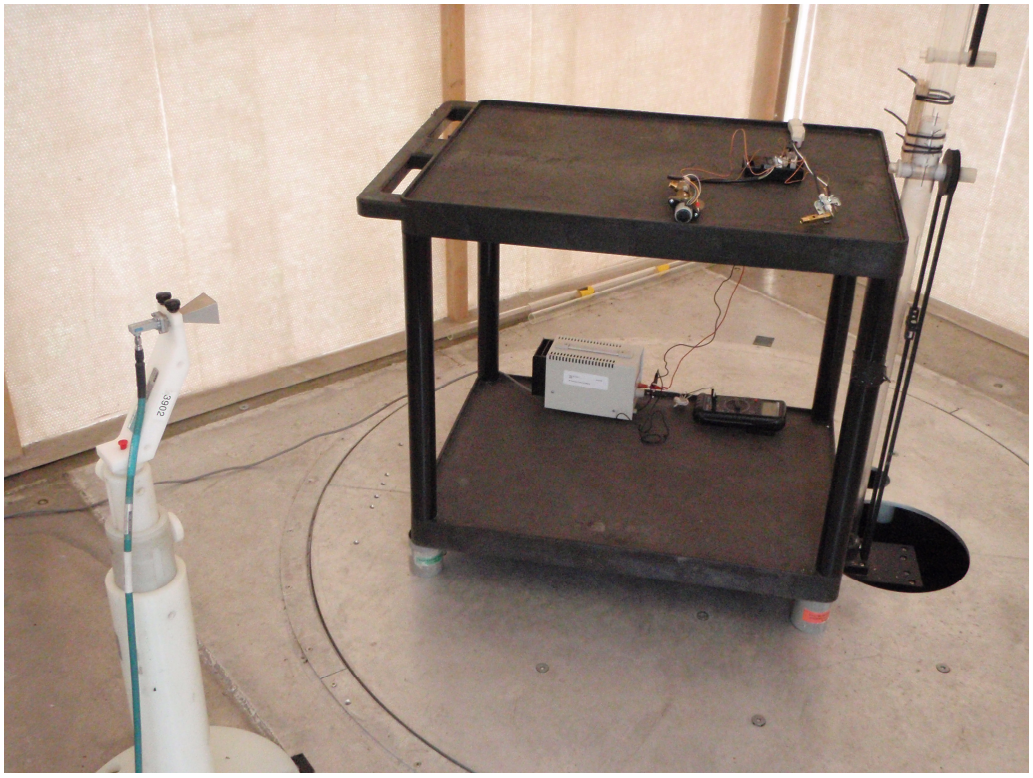


Radiated Emissions Test Configuration 9kHz – 30MHz

Radiated Emissions Test Configuration 1GHz - 18GHz



Radiated Emissions Test Configuration 18GHz – 24GHz



Radiated Emissions Environmental Conditions

Power Supply	4.5V
Temperature	21.5°C
Relative Humidity	42%
Barometric Pressure	997mb

Radiated Emissions Measurement Uncertainties

Frequency	± 200kHz
Amplitude	± 4.6dB

The uncertainties stated are calculated in accordance with the requirements of UKAS with a confidence level of 95%.

Radiated Emissions Test Equipment Used

Equipment Type	Model Number	Calibration Date	Calibration Cycle
Spectrum Analyser	Rohde and Schwarz FSP 64.4391K40	4th September 2008	2 Years
Receiver System	HP EMC Set (85733)	4th September 2008	2 Years
Spectrum Analyser	HP8563E	13th March 2008	2 Years
Antenna 0.009 – 30MHz	EMCO 6152	30th June 2008	3 Years
Antenna 30-300MHz	Chase VBA 606	21st November 2008	3 Years
Antenna 300-1000MHz	EMCO 3146	8th September 2009	3 Years
Antenna 1-18GHz	EMCO 3115	18th April 2008	2 Years
Antenna 18-24GHz	EMCO 3160-09	9th November 2007	2 Years

7.5 Occupied Bandwidth 2.1049

Operating mode

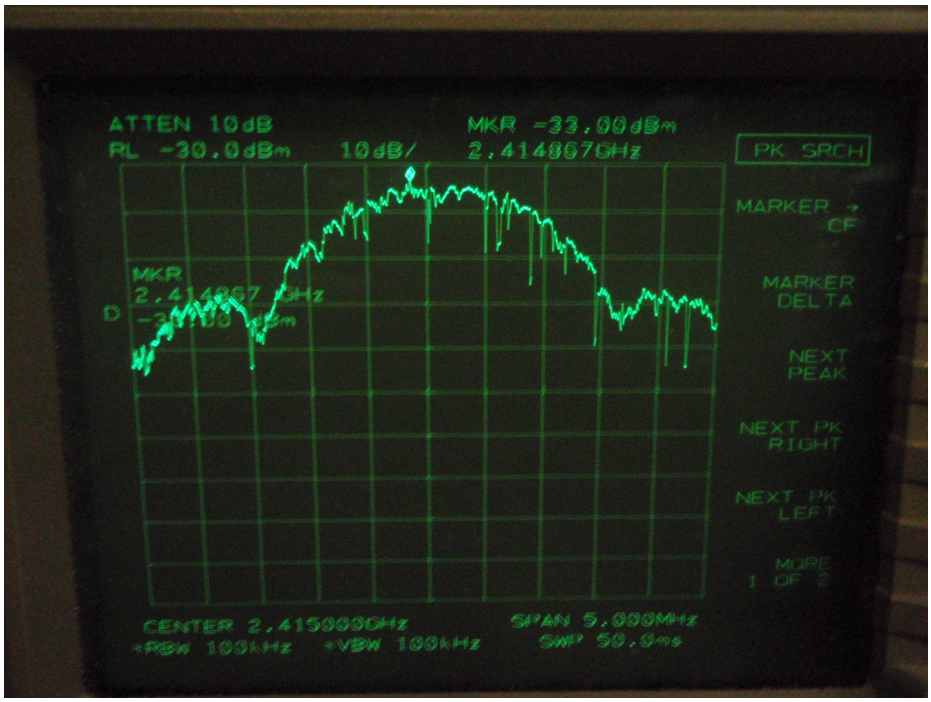
The test was performed whilst the equipment under test periodically “handshakes” with the transmitter.

Test Results

Test performed at 4.5V, 20°C.

Measurement Resolution BW set to 100kHz.

Bandwidth	Lower Frequency	Upper Frequency
26 dB	2.413708	2.416567



Occupied Bandwidth Environmental Condition

Power Supply	4.5V
Temperature	21.5°C
Relative Humidity	50%
Barometric Pressure	993mb

Test Equipment Used

Equipment Type	Model Number
Spectrum Analyser	HP 8563E
Environmental Chamber	VCS 4100

7.6 Frequency Stability 15.249

Operating mode

The compliance test was performed in mode 1

Voltage	-20°C	20°C	50°C
	Frequency	Frequency	Frequency
4.5V (nominal)	2.414900GHz	**2.414867GHz Nominal**	2.414930GHz
3.83V (0.85%)	-	2.414930GHz	-
5.1V (115%)	-	2.415430GHz	-

Limits are the nominal carrier frequency +/- 0.001% = 2.412452133GHz - 2.417281867GHz.

Frequency Stability Environmental Condition

Power Supply	3V
Temperature	21.5 °C
Relative Humidity	50%
Barometric Pressure	993mb

Test Equipment Used

Equipment Type	Model Number
Spectrum Analyser	HP 8563E
Environmental Chamber	VCS 4100