THE STANDARDS INSTITUTION OF ISRAEL

Electronics & Telematics Laboratory

Test Report No. 8912301385

Applicant: Visonic Inc.

Equipment Under Test:

Key fob transmitter

Model: ***MCT-237***

FCC ID: ***GSAMCT237***

From The Standards Institution
Of Israel
Industry Division
Electronics & Telematics Laboratory
EMC Section

ACLASS

ACLASS Accreditation Services
Certificate Number: IT-1359

Test Report No.: 8912301385 **Page 1 of 21 pages**

Title: Test on Key fob transmitter **Model: MCT-237** **FCC ID: GSAMCT237**

Applicant:	Visonic Inc.
Address:	10 Northwood Drive, Bloomfield, CT 06002-1911, United States
Sample for test selected by:	The customer
The date of test:	22 February 2009

Description of Equipment Under Test (EUT):	Key fob transmitter.
Model:	MCT-237
Manufactured by:	Visonic Inc.

Reference Documents:

- CFR 47 FCC: Rules and Regulations; Part 15. "Radio frequency devices";
  Subpart B: "Intentional radiators" (2006)
  Subpart C: "Unintentional radiators" (2006),
  Section 15.205. "Restricted bands of operations",
  Section 15.209. "Radiated emission limits, general requirements".
  "Radiated Emission Limits, Additional Provisions";
  Section 15.231. "Periodic operation in the bands 40.66 – 40.70 MHz, and above 70 MHz".
- Industry Canada: RSS-210, Issue 7, "Low-power Licence-exempt Radiocommunication Devices"
  Annex 1. Momentarily Operated Devices and Remote Control
  ICES-003: Issue 4. "Digital Apparatus"

Test Results: The EUT meets the following requirements of:

CFR 47 FCC Part 15: Subpart B Section 15.109 (a)
Subpart C Section 15.231,
Section 15.209,
Section 15.205.

RSS-210: Annex 1

ICES-003: Section 5.5

This Test Report contains 21 pages and may be used only in full.	This Test Report applies only to the specimen tested and may not be applied to other specimens of the same product.

Table of Contents

1. EUT Description and operation

1.1. General description:

* Note: the customer supplied all information in clause below.

The MCT-237 is a miniature key fob transceiver designed for use in alarm system. The devise enables the user to arm/disarm the alarm system and to view system status. Duration of EUT transmition is limited by program and is less than 0.4 sec.

Declare output transmission power:	-18.0 dBm@ 315 MHz
Type of modulation:	ASK(ON-OFF keying)
Antenna type:	Integrated, spiral

The EUT dimensions: 75 mm x 38 mm x 18 mm.
The EUT power source: 1.5 Volt AAA alkaline batteries.

The EUT's block diagram is shown in Figures 1
The EUT external and internal views are presented in Photos #1 and #2.

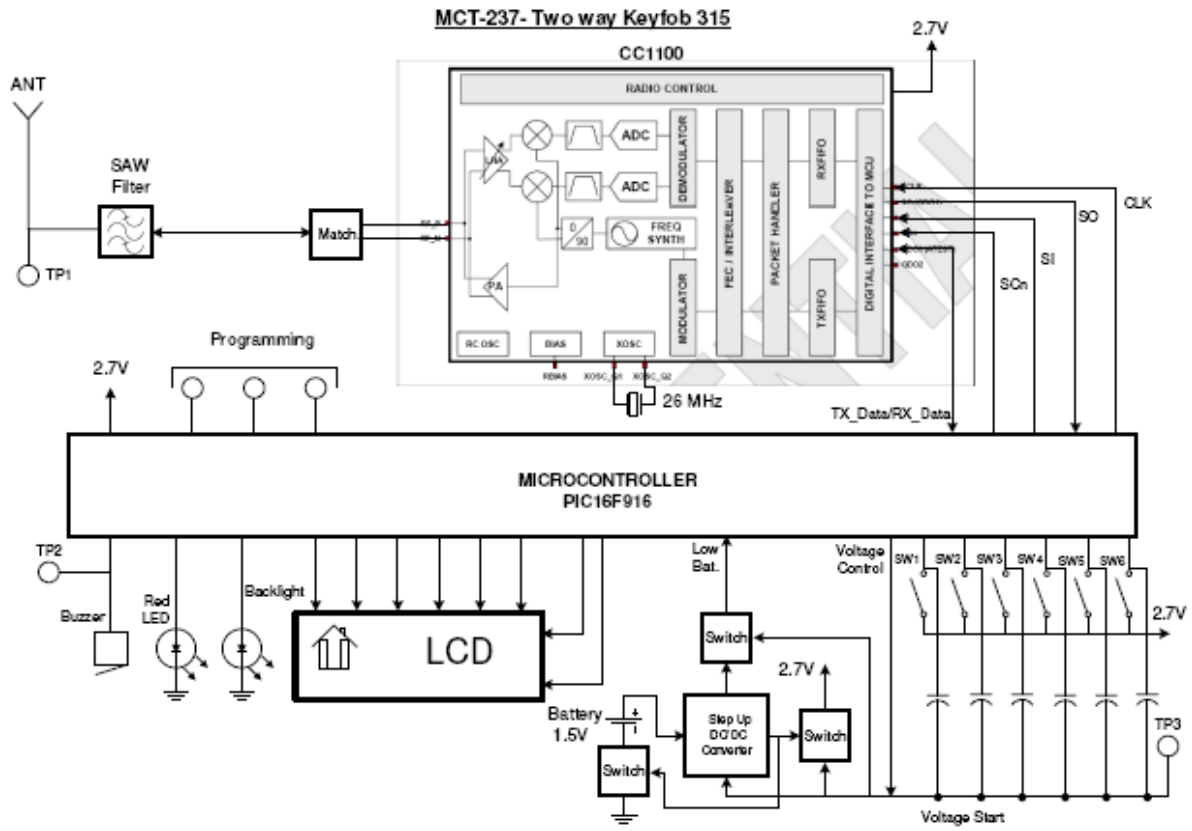


Figure 1. Transceiver block diagram.

2. Test summary

Parameter	FCC Part 15 Reference paragraph	Comply/not comply with the requirements
Radiated emission test.	Subpart B Section 15.109 Subpart C Section 15.209	Comply
Test of field strength emission from intentional radiators	"Radiated Emission Limits, Additional Provisions"; Section 15.231.	Comply
Radiated emission from intentional radiators in restricted bands	Subpart C Section 15.205	Comply
Occupied bandwidth	Subpart C Section 15.231	Comply

Telematics Laboratory

February 2009

Name: Eng. Yuri Rozenberg
Position: Head of EMC Branch

Name: Michael Feldman
Position: Test Technician

Photo 1. EUT's external and internal view

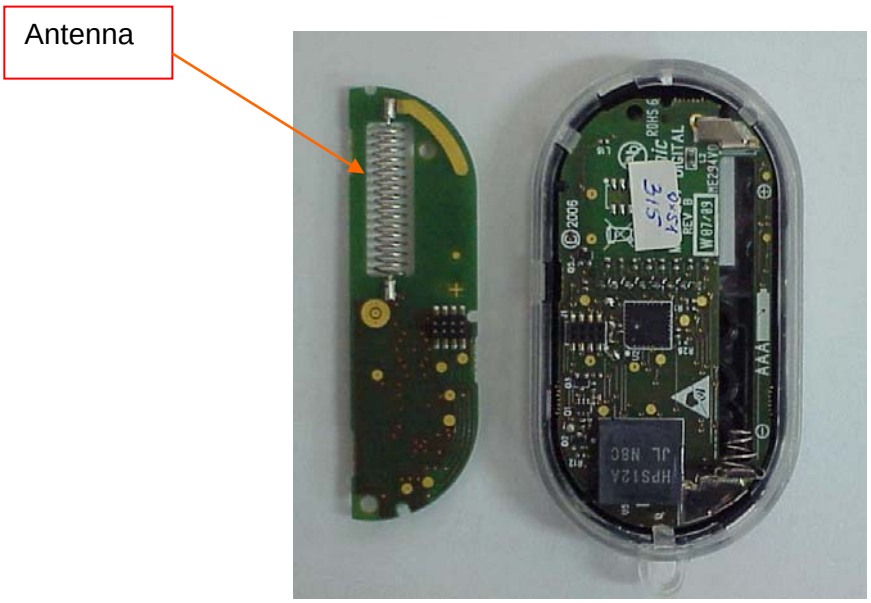


Photo # 2. EUT's PCB view.

Photo 3. Spurious emissions test setup.

2.1. Potential emission sources:

The potential emission sources are detailed in Table 1.

Table 1. Potential emission sources

Frequency	Location
10.0 MHz crystal	PCB
26.0 MHz crystal	PCB
315 MHz RF signal	Base unit

2.2. EUT setup and operation:

Measurements of transmitter were performed in continue transmition mode. Respective tests were performed in Transmission (Tx) and Receiving (Rx) modes.

3. Measurements, examinations and derived results

3.1. Location of the Test Site:

Preliminary radiated test was conducted at the EMC laboratory of the Standards Institution of Israel in Tel-Aviv.

All other tests were conducted in an Open Area Test Site located at Kibbutz Native Halamed Hai in Emek HaEla, Israel.

3.2. Test condition:

Temperature: 22 °C. Humidity: 56 %. Atmospheric pressure: 1006 mbar.

3.3. Initial visual check and functional test:

Initial visual check and brief built- in- test of the EUT was performed before testing.

- No external damages were found.
- The test on the EUT passed successfully.

3.4. Radiated emission test.

3.4.1. General:

Per FCC Part 15 Subpart B Section 15.109 and subpart C Section 15.231, 15.205, 15.209

- Initial scans were made using a peak detector but still using the appropriate ANSI IF bandwidth.
- A tolerance limit was set 10 dB below the specification limit. Levels above the tolerance limit were retested using the Peak detector.

3.4.2. Preliminary radiated emission tests:

Preliminary investigation from 9 kHz up to ten harmonic of carrier frequency was performed. Test was conducted in a semi-anechoic chamber at distance 3 meters. The EUT was setup in its typical configuration and operated in its various modes. For each mode of operation the frequency spectrum was monitored. EUT configuration, cable configuration and mode of operation, which produced the maximum level of emission, were documented. A list of frequencies to be tested was prepared.

3.4.3. Final measurements:

The final radiated emission measurements were performed at the Open Area Test Site at the same (3 m) test distance. Test was started with a new fresh battery. Measured voltage was 1.51V The EUT was operated as described above. The EUT was installed on a turn - table. Biconilog and Double Ridged Guide antennas were used. The measurements were performed at each frequency that founded previously at which the signal level was 10 dB below the limit or less. The levels were maximized by rotating through three orthogonal axes, rotating turntable through 360° and changing antenna-to-EUT polarization from vertical to horizontal. The worse case result was noted in tables.

3.4.4. Radiated emission test results:

All received emissions from the EUT were found below FCC Part 15 Subpart B Section 15.109 and Subpart C Section 15.209, 15.231.
All emissions, measured from the EUT at the 9kHz-30MHz frequency range were to 20 dB at least below limit.
Measured result in receive mode present in plots ##5, 6
Section 15.231 specified limit is presented in clause 2.6.
Final result measurements in transmit mode are presented in tables and plots #1 - #4 in section 2.6.5.

3.5. Common conditions for the periodic operation in the band above 70MHz.

3.5.1. General:

Per FCC Part 15 Subpart C clause 15.231 (a).

3.5.2. Requirements:

15.231(a) – Transmitter is defined as a part of alarm system.
15.231(a)(1) – Transmission duration is limited by program and is less than 0.4 second. See plot # 8.
15.231(a)(2) – Not applicable. Transmitter is not activated automatically.
15.231(a)(3) – Not applicable. Transmitter is not intended for regular predetermined interval transmissions.
15.231(a)(4) – Not applicable. Transmitter is not operates during the pendency of the alarm conditions.
15.231(a)(5) - Not applicable. Transmitter doesn't exceed the limits of this section.

3.5.3. Summary:

The EUT is complies with the requirements of clause 15.231(a).

3.6. Test of field strength emission from intentional radiator.

3.6.1. General:

Per FCC Part 15 Subpart C clause 15.231 (b) and RSS-210 clause A1.1.2 (1).

3.6.2. Requirements:

The EUT's operation frequency is 315 MHz.
The field strength emissions from intentional radiators operated on this frequency shall comply with the limit based on the average value or as an alternative CISPR quasi-peak detector may be used.

Fundamental Frequency	Calculated Field Strength limit of Fundamental dB (μV/m)	Calculated Field Strength limit of Harmonics dB (μV/m)
315 MHz	75.6	55.6

Note: Peak field strength of Harmonics shall not exceed the maximum permitted specified limit above by more than 20 dB.
Field strength limits are specified at a distance of 3 meters.

3.6.3. Test procedure:

The test was conducted according to clause 15.231.

3.6.4. Test summery:

The tested unit meets the standard requirement.

3.6.5. Test results:

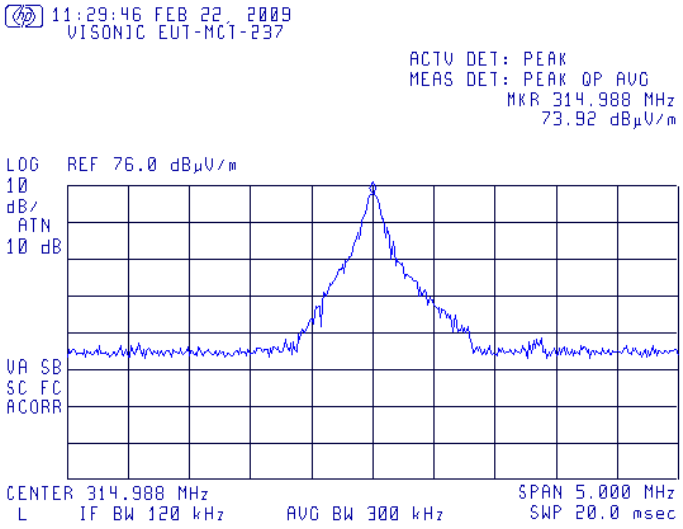
Carrier frequency MHz	Antenna polarization V/H	Peak Amplitude dB (µV/m)	Avg amplitude** dB (µV/m)	Limit@ 3m dB (µV/m)
315.0	V	73.9	69.5	75.6

For recorded Fundamental frequencies result see plots #1.
All received spurious emissions were found below the specified limit.
Founded spurious emissions results presented in tables below.

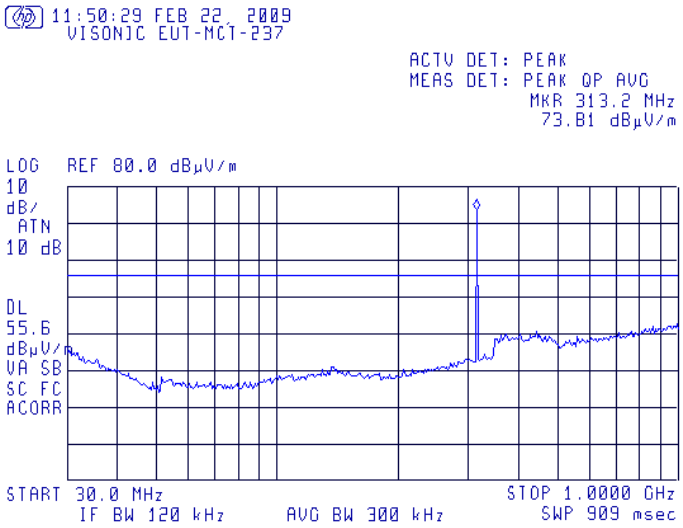
Spurious emissions test result.

Freq. MHz	Peak Ampl dB (µV/m)	Peak limit dB (µV/m)	Margin dB	Avg ampl** dB (µV/m)	Specified @3m limit, dB (µV/m)	Margin dB	Reference Plot
944.99	41.1	75.6	34.5	36.7	55.6	18.8	Plot #3

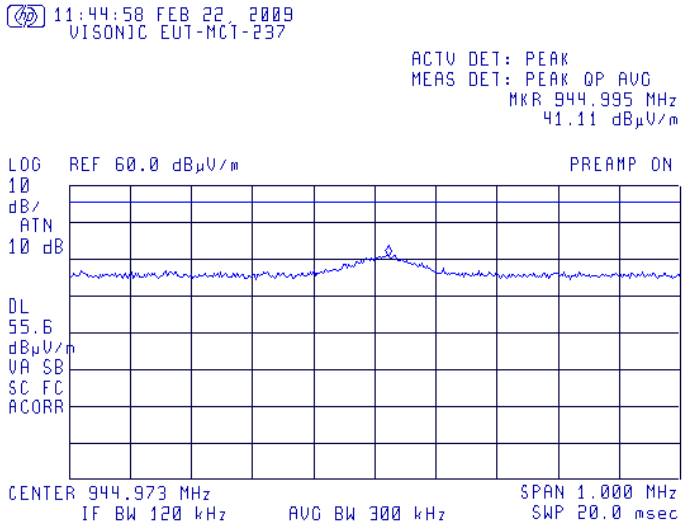
Worse case result noted in table was found in horizontal polarization.
**Average amplitude result was calculated from measured Peak value – Average factor.
Average factor = 20 Log Tx on/100msec = 20 Log [60ms/100] = -4.4 dB
For transmitter average factor calculation see plots # 7, 8.



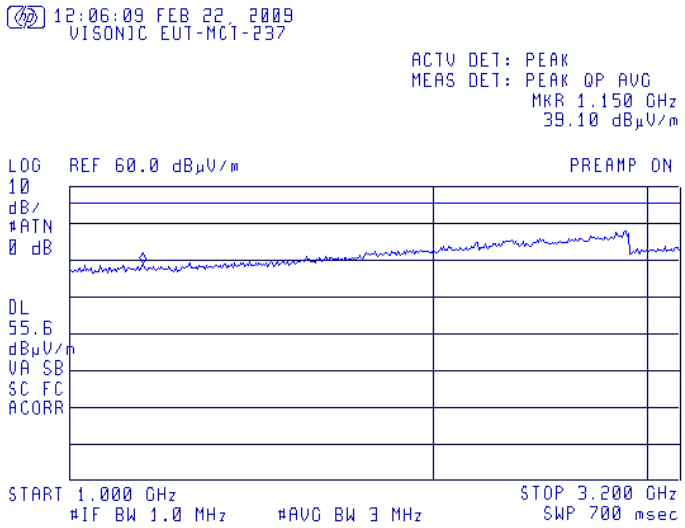
Plot # 1. Field strength of fundamental frequency 315 MHz.



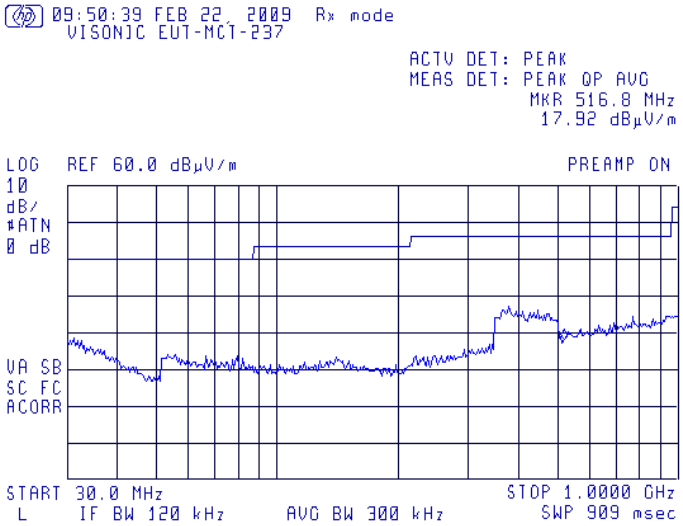
Plot # 2. Spurious emissions scan 30 – 1000 MHz. Test distance =3m.



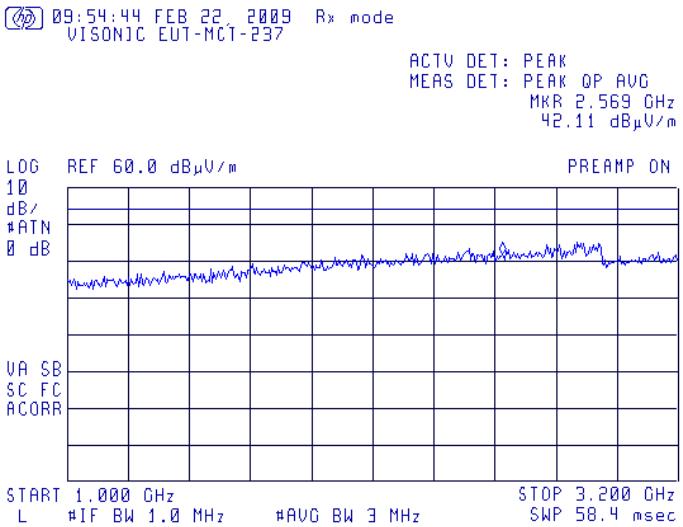
Plot # 3. The carrier frequency 3 td harmonic. Detector peak. Test distance =3m



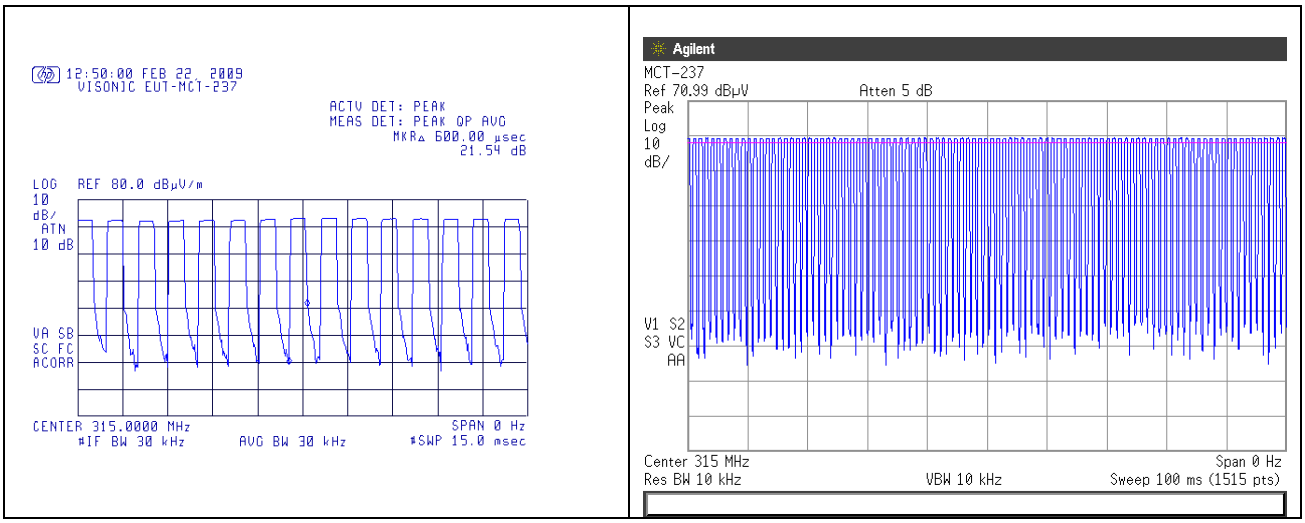
Plot # 4. Spurious emissions scan 1 – 3.2 GHz. Test distance =3m.



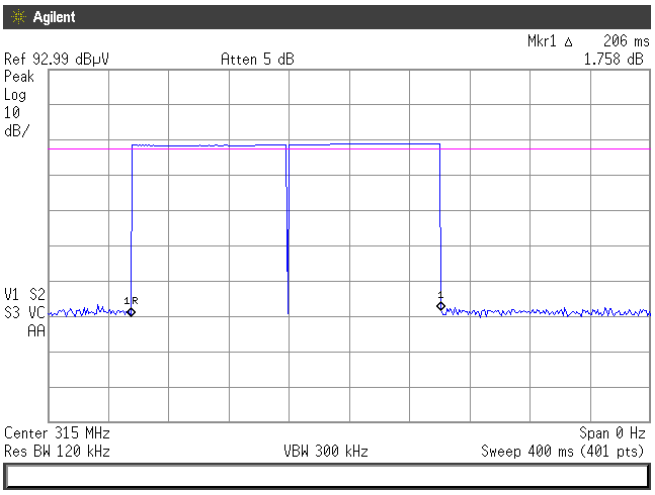
Plot # 5. Rx mode. Spurious emissions
Frequency range from 30 MHz to 1000 MHz. Test distance =3m.



Plot # 6. Rx mode. Preliminary scan of spurious emissions.
Frequency range from 1 GHz to 3.2 GHz. Test distance =3m



Plot # 7. Transmition duration - Tx on



Plot # 8. Transmition message duration

AVG factor was calculated as 20 Log (Tx on/100 msec). Tx on = 0.6 ms x 100 = 60 ms
AVG factor = 20 Log [(60 ms)/100] = -4.4 dB

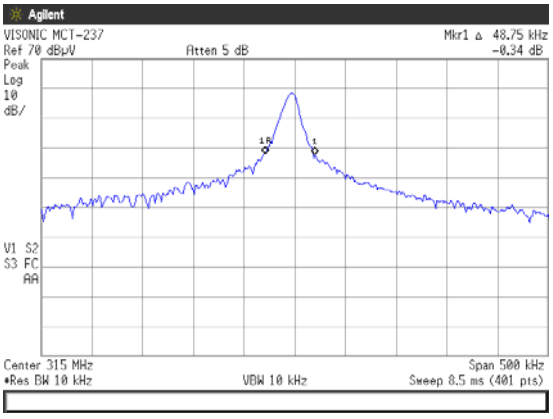
3.7. Test of occupied bandwidth per 15.231(c), RSS-210 A1.1.3

3.7.1. Requirements:

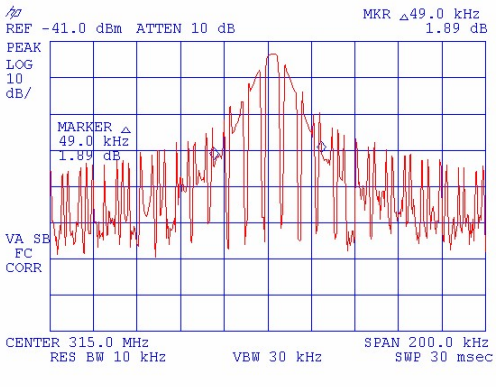
The bandwidth of the emissions shall be no wide than 0.25% of the center frequency for devises operating above 70 MHz and below 900 MHz. Bandwidth is determined at the points 20 dB down from the centre of modulated carrier and as 99% bandwidth.
For 315 MHz centre frequency allowed occupied bandwidth shell be less than (315/100) 0.25 = 0.787 MHz.

3.7.2. Test results:

Test result is presented in plot # 13 and # 14 below.



Plot # 9. 20 dB bandwidth test.



Plot # 10. 99% bandwidth test

3.7.3. Test summary:

20 dB occupied bandwidth is 48.75 kHz.
Measured 99% bandwidth is 49.0 kHz.
The tested unit meets the standards requirements.

4. Appendix 1. Test equipment used

All measurements equipment is on SII calibration schedule with a recalibration interval not exceeding one year.

Instrument	MFR	Model	Serial No.	Due calibration date
EMI Receiver 9 kHz – 6.5 GHz	HP	8546A+85460 A	SII 4068	April 2009
Antenna Loop 0.009 - 30 MHz	EMCO	6502	SII 4874	Mar 09
Antenna Biconilog 30 – 2000 MHz	Schaffner-Chase	CBL6112B	S/N 2714	Aug 2009
EMI Analyser 9 kHz - 26.5 GHz	HP	E7405A	SII 4944	June 2009
Antenna Double Ridged Guide, 1-18 GHz	EMCO	3115	SII4873	Aug 2009
Oscilloscope	HP	54610B	US37340682	May 2009
RF cable, 4m	Sucoflex	104PE	21328/4PE	Oct 2009
Antenna Mast	R&S	HCM	100002	N/A
Metallic turntable	R&S	HCT12	100001	N/A
Positioning controller	R&S	HCC	100002	N/A

5. Appendix 2: Antenna Factor and Cable Loss

Cable Loss (10m cable + Mast)

Point	Frequency (MHz)	Cable Loss (dB)	Point	Frequency (MHz)	Cable Loss (dB)
1	30	0.53	21	1000	3.68
2	50	0.75	22	1100	3.82
3	100	1.08	23	1200	4.07
4	150	1.39	24	1300	4.24
5	200	1.61	25	1400	4.43
6	250	1.752	26	1500	4.6
7	300	2.00	27	1600	4.7
8	350	2.15	28	1700	4.85
9	400	2.26	29	1800	4.98
10	450	2.383	30	1900	5.19
11	500	2.52	31	2000	5.34
12	550	2.606	32	2100	5.51
13	600	2.75	33	2200	5.69
14	650	2.856	34	2300	5.89
15	700	3.06	35	2400	6.07
16	750	3.20	36	2500	6.22
17	800	3.27	37	2600	6.28
18	850	3.38	38	2700	6.41
19	900	3.46	39	2800	6.53
20	950	3.55	40	2900	6.84

Table 2. Antenna Factor

Biconilog Antenna, Model Number: CBL-6112B, S/N: 2714
3 m calibration

Frequency (MHz)	Antenna Factor (dB/m)	Frequency (MHz)	Antenna Factor (dB/m)	Frequency (MHz)	Antenna Factor (dB/m)	Frequency (MHz)	Antenna Factor (dB/m)
Vertical Polarization				Horizontal Polarization			
26.00	20.77	625.00	19.10	26.00	20.39	625.00	19.08
28.00	19.77	650.00	19.20	28.00	19.15	650.00	19.26
30.00	18.72	675.00	19.05	30.00	18.29	675.00	19.12
40.00	14.76	700.00	19.26	40.00	12.64	700.00	19.11
50.00	8.32	725.00	19.73	50.00	7.99	725.00	19.49
60.00	6.15	750.00	20.11	60.00	5.95	750.00	19.94
70.00	6.49	775.00	20.41	70.00	6.04	775.00	20.07
80.00	7.26	800.00	20.50	80.00	7.60	800.00	20.18
90.00	8.83	825.00	20.57	90.00	9.07	825.00	20.36
100.00	10.55	850.00	20.73	100.00	10.34	850.00	20.57
110.00	11.38	875.00	20.92	110.00	11.12	875.00	20.83
120.00	11.71	900.00	20.79	120.00	11.46	900.00	20.74
130.00	11.57	925.00	21.02	130.00	11.47	925.00	21.17
140.00	11.09	950.00	21.32	140.00	11.15	950.00	21.11
150.00	10.46	975.00	21.76	150.00	10.50	975.00	21.52
160.00	9.82	1,000.00	21.97	160.00	9.86	1,000.00	21.64
170.00	9.52	1,050.00	22.55	170.00	9.58	1,050.00	22.02
180.00	9.18	1,100.00	22.47	180.00	9.28	1,100.00	22.16
190.00	8.90	1,150.00	22.78	190.00	9.54	1,150.00	22.44
200.00	9.11	1,200.00	22.77	200.00	9.82	1,200.00	22.86
225.00	9.70	1,250.00	23.36	225.00	10.42	1,250.00	23.37
250.00	12.41	1,300.00	23.90	250.00	12.43	1,300.00	23.86
275.00	12.81	1,350.00	24.19	275.00	13.19	1,350.00	24.02
300.00	13.37	1,400.00	24.42	300.00	13.48	1,400.00	24.42
325.00	13.70	1,450.00	24.83	325.00	13.73	1,450.00	24.61
350.00	14.45	1,500.00	24.88	350.00	14.61	1,500.00	25.02
375.00	14.90	1,550.00	24.85	375.00	15.15	1,550.00	25.27
400.00	15.63	1,600.00	25.06	400.00	15.74	1,600.00	25.27
425.00	16.38	1,650.00	25.55	425.00	16.52	1,650.00	25.50
450.00	16.43	1,700.00	26.20	450.00	16.54	1,700.00	25.48
475.00	17.28	1,750.00	26.45	475.00	17.28	1,750.00	26.35
500.00	17.41	1,800.00	26.58	500.00	17.47	1,800.00	26.51
525.00	17.35	1,850.00	27.30	525.00	17.31	1,850.00	26.63
550.00	18.97	1,900.00	27.96	550.00	18.64	1,900.00	27.04
575.00	18.87	1,950.00	27.80	575.00	18.60	1,950.00	27.13
600.00	18.82	2,000.00	27.73	600.00	19.04	2,000.00	27.20

Antenna Factor
Double Ridged Guide Antenna mfr EMCO model 3115 1m calibration

Point	Frequency (MHz)	Antenna Factor (dB/m)
1	1000	23.9
2	2000	28.3
3	3000	31.0
4	4000	33.1
5	4500	32.5
6	5000	32.4
7	6000	53.7
8	6500	35.6
9	7000	36.4
10	7500	36.9
11	8000	37.0
12	8500	38.0
13	9000	38.6
14	9500	38.4
15	10000	38.4
16	10500	38.4
17	11000	38.9
18	11500	39.6
19	12000	39.4
20	12500	39.2
21	13000	40.3
22	13500	41.0
23	14000	41.2
24	14500	41.3
25	15000	40.0
26	15500	38.0
27	16000	38.1
28	16500	40.3
29	17000	42.2
30	17500	44.6
31	18000	46.2

Cable Loss
Type: Sucoflex 104PE; Ser.No.21328/4PE; 4 m length

Point	Frequency (GHz)	Cable Loss (dB)
1	0.0-1.0	1.7
2	1.0– 3.5	3.2
3	3.5– 5.5	4.0
4	5.5 – 7.5	4.7
5	7.5 – 9.5	5.3
6	9.5 – 10.5	5.6
7	10.5 – 12.5	6.2
8	12.5 – 14.5	6.8
9	14.5 – 16.5	7.5
10	16.5 – 18.0	8.1