

FCC EVALUATION REPORT FOR CERTIFICATION

Manufacturer : Hubsung Plastics, Ltd.
182-3, Dodang-dong, Wonmi-gu, Bucheon,
Gyeonggi-do, South Korea 420-806
Attn: Mr. Seongho Ko, President

Date of Issue : December 8, 2010
Order Number: GETEC-C1-10-197
Test Report Number: GETEC-E3-10-127
Test Site: Gumi College EMC Center
FCC Registration Number: (100749, 443957)

FCC ID. : RE6CUBE24G3

Applicant : Hubsung Plastics, Ltd.

Rule Part(s)	: FCC Part 15 Subpart C-Intentional Radiator § 15.247
Test method	: Public Notice DA 00-705 (Guidance on measurement for Frequency hopping spread spectrum system)
Equipment Class	: Part 15 Spread Spectrum Transmitter (DSS)
EUT Type	: 2.4 GHz FHSS Transmitter
Type of Authority	: Certification
Model Name	: Cube3
Trade Name	: Cube

This equipment has been shown to be in compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.4-2003

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Tested by,

Reviewed by,



Soon-Hoon Jeong, Engineer
GUMI College EMC center



Jae-Hoon Jeong, Senior Engineer
GUMI College EMC center



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Scope: *Measurement and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and / or unintentional radiators for compliance with technical rules and regulations of the Federal Communications Commission.*

1. General Information

Applicant: Hubsung Plastics, Ltd.

Applicant address: 182-3, Dodang-dong, Wonmi-gu, Bucheon, Gyeonggi-do, South Korea 420-806

Manufacturer: Hubsung Plastics, Ltd.

Manufacturer address: 182-3, Dodang-dong, Wonmi-gu, Bucheon, Gyeonggi-do, South Korea 420-806

Contact person: Mr. Seongho Ko, President

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- **FCC ID.** RE6CUBE24G3
- **Equipment Class** Spread Spectrum Transmitter (DSS)
- **EUT Type** 2.4 GHz FHSS Transmitter
- **Model Name** Cube3
- **Rule Part(s)** FCC Part 15, Subpart C-Intentional Radiator § 15.247
- **Test Method** Public Notice DA 00-705
(Guidance on measurement for frequency hopping spread spectrum systems)
- **Type of Authority** Certification
- **Test Procedure(s)** ANSI C63.4 (2003)
- **Dates of Test** November 29 ~ December 1, 2010
- **Place of Test** **Gumi College EMC Center** (FCC Registration No.: 100749, 443957)
407, Bugok-Dong, Gumi-si, Gyeongsangbuk-Do, Korea
- **Test Report Number** GETEC-E3-10-127
- **Dates of Issue** December 8, 2010



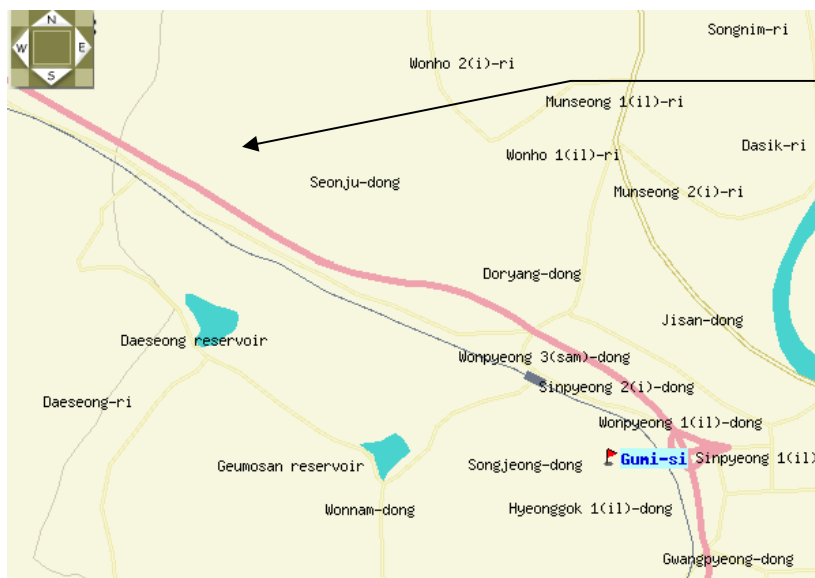
2. Introduction

The measurement procedure described in American National Standard for Methods of Measurement of Radio-Nose Emissions From Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (ASNI C63.4-2003) was used in determining radiated and conducted emissions emanating from **Hubsung Plastics, Ltd. 2.4 GHz FHSS Transmitter (Model name: Cube3)**

These measurement tests were conducted at **Gumi College EMC Center**.

The site address is 407, Bugok-Dong, Gumi-si, Gyeongsangbuk-Do, Korea

This test site is one of the highest point of Gumi 1 college at about 200 kilometers away from Seoul city and 40 kilometers away from Daegu city. It is located in the valley surrounded by mountains in all directions where ambient radio signal conditions are quiet and a favorable area to measure the radio frequency interference on open field test site for the computing and ISM devices manufactures. The detailed description of the measurement facility was found to be in compliance with the requirements of §2.948 according to ANSI C63.4 on October 19, 1992



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Fig 1. The map above shows the Gumi College in vicinity area.



3. Product Information

3.1 Description of EUT

The Equipment under Test (EUT) is the **Hubsung Plastics, Ltd. 2.4 GHz FHSS Transmitter (Model Name: Cube3) FCC ID.: RE6CUBE24G3**

Size : 38 mm(W) × 30.5 mm(H) × 16.5 mm(D)

Weight : 14.80 g

Frequency channel List

CH	Frequency	CH	Frequency	CH	Frequency	CH	Frequency
0	2 402.999 695	31	2 413.330 506	62	2 423.661 316	93	2 433.992 127
1	2 403.332 947	32	2 413.663 757	63	2 423.994 568	94	2 434.325 379
2	2 403.666 199	33	2 413.997 009	64	2 424.327 820	95	2 434.658 631
3	2 403.999 451	34	2 414.330 261	65	2 424.661 072	96	2 434.991 882
4	2 404.332 703	35	2 414.663 513	66	2 424.994 324	97	2 435.325 134
5	2 404.665 955	36	2 414.996 765	67	2 425.327 576	98	2 435.658 386
6	2 404.999 207	37	2 415.330 017	68	2 425.660 828	99	2 435.991 638
7	2 405.332 459	38	2 415.663 269	69	2 425.994 080	100	2 436.324 890
8	2 405.665 711	39	2 415.996 521	70	2 426.327 332	101	2 436.658 142
9	2 405.998 963	40	2 416.329 773	71	2 426.660 584	102	2 436.991 394
10	2 406.332 215	41	2 416.663 025	72	2 426.993 836	103	2 437.324 646
11	2 406.665 466	42	2 416.996 277	73	2 427.327 088	104	2 437.657 898
12	2 406.998 718	43	2 417.329 529	74	2 427.660 340	105	2 437.991 150
13	2 407.331 970	44	2 417.662 781	75	2 427.993 591	106	2 438.324 402
14	2 407.665 222	45	2 417.996 033	76	2 428.326 843	107	2 438.657 654
15	2 407.998 474	46	2 418.329 285	77	2 428.660 095	108	2 438.990 906
16	2 408.331 726	47	2 418.662 537	78	2 428.993 347	109	2 439.324 158
17	2 408.664 978	48	2 418.995 789	79	2 429.326 599	110	2 439.657 410
18	2 408.998 230	49	2 419.329 041	80	2 429.659 851	111	2 439.990 662
19	2 409.331 482	50	2 419.662 293	81	2 429.993 103	112	2 440.323 914
20	2 409.664 734	51	2 419.995 545	82	2 430.326 355	113	2 440.657 166
21	2 409.997 986	52	2 420.328 797	83	2 430.659 607	114	2 440.990 418
22	2 410.331 238	53	2 420.662 049	84	2 430.992 859	115	2 441.323 670
23	2 410.664 490	54	2 420.995 300	85	2 431.326 111	116	2 441.656 922
24	2 410.997 742	55	2 421.328 552	86	2 431.659 363	117	2 441.990 174
25	2 411.330 994	56	2 421.661 804	87	2 431.992 615	118	2 442.323 425
26	2 411.664 246	57	2 421.995 056	88	2 432.325 867	119	2 442.656 677
27	2 411.997 498	58	2 422.328 308	89	2 432.659 119	120	2 442.989 929
28	2 412.330 750	59	2 422.661 560	90	2 432.992 371	121	2 443.323 181
29	2 412.664 002	60	2 422.994 812	91	2 433.325 623	122	2 443.656 433
30	2 412.997 254	61	2 423.328 064	92	2 433.658 875	123	2 443.989 685

EUT Type: 2.4 GHz FHSS Transmitter

FCC ID.: RE6CUBE24G3



CH	Frequency	CH	Frequency	CH	Frequency
124	2 444.322 937	163	2 457.319 763	202	2 470.316 590
125	2 444.656 189	164	2 457.653 015	203	2 470.649 841
126	2 444.989 441	165	2 457.986 267	204	2 470.983 093
127	2 445.322 693	166	2 458.319 519	205	2 471.316 345
128	2 445.655 945	167	2 458.652 771	206	2 471.649 597
129	2 445.989 197	168	2 458.986 023	207	2 471.982 849
130	2 446.322 449	169	2 459.319 275	208	2 472.316 101
131	2 446.655 701	170	2 459.652 527	209	2 472.649 353
132	2 446.988 953	171	2 459.985 779	210	2 472.982 605
133	2 447.322 205	172	2 460.319 031	211	2 473.315 857
134	2 447.655 457	173	2 460.652 283	212	2 473.649 109
135	2 447.988 709	174	2 460.985 535	213	2 473.982 361
136	2 448.321 961	175	2 461.318 787	214	2 474.315 613
137	2 448.655 213	176	2 461.652 039	215	2 474.648 865
138	2 448.988 465	177	2 461.985 291	216	2 474.982 117
139	2 449.321 716	178	2 462.318 543	217	2 475.315 369
140	2 449.654 968	179	2 462.651 795	218	2 475.648 621
141	2 449.988 220	180	2 462.985 047	219	2 475.981 873
142	2 450.321 472	181	2 463.318 298	220	2 476.315 125
143	2 450.654 724	182	2 463.651 550	221	2 476.648 377
144	2 450.987 976	183	2 463.984 802	222	2 476.981 629
145	2 451.321 228	184	2 464.318 054	223	2 477.314 881
146	2 451.654 480	185	2 464.651 306	224	2 477.648 132
147	2 451.987 732	186	2 464.984 558	225	2 477.981 384
148	2 452.320 984	187	2 465.317 810	226	2 478.314 636
149	2 452.654 236	188	2 465.651 062	227	2 478.647 888
150	2 452.987 488	189	2 465.984 314	228	2 478.981 140
151	2 453.320 740	190	2 466.317 566	229	2 479.314 392
152	2 453.653 992	191	2 466.650 818	230	2 479.647 644
153	2 453.987 244	192	2 466.984 070	231	2 479.980 896
154	2 454.320 496	193	2 467.317 322	232	2 480.314 148
155	2 454.653 748	194	2 467.650 574	233	2 480.647 400
156	2 454.987 000	195	2 467.983 826	234	2 480.980 652
157	2 455.320 252	196	2 468.317 078		
158	2 455.653 504	197	2 468.650 330		
159	2 455.986 756	198	2 468.983 582		
160	2 456.320 007	199	2 469.316 834		
161	2 456.653 259	200	2 469.650 086		
162	2 456.986 511	201	2 469.983 338		

* 24 channels at random access for the total 235 channels. (Selected channel is gray box)



3.2 Support Equipment / Cables used

3.2.1 Used Support Equipment

Description	Manufacturer	Model Name	S/N & FCC ID.
Nickel cadmium battery	Futaba	NR-4J	S/N: N/A FCC ID.: N/A

See “Appendix E – Test Setup Photographs” for actual system test set-up

3.2.2 System configuration

Description	Manufacturer	Model Name	S/N & FCC ID.
None	-	-	S/N: - FCC ID.: -

3.2.3 Used Cable(s)

Cable Name	Condition	Description
None.	-	-

3.3 Modification Item(s)

-. None



4. Description of tests

4.1 Test Condition

The EUT was installed, arranged and operated in a manner that is most representative of equipment as typically used. The measurements were carried out while varying operating modes and cable positions within typically arrangement to determine maximum emission level.

The representative and worst test mode(s) were noted in the test report.

- Test Voltage / Frequency : DC 4.8 V supplied from the nickel cadmium battery
(The EUT used battery power. So, the conducted emission test was skip)
- Test Mode(s): RF transmitting mode

5. Antenna Requirement - §5.203

An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the applicant can be used with the device. The use of permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with this requirement.

5.1 Description of Antenna

The **Hubsung Plastics, Ltd. 2.4 GHz FHSS Transmitter** comply with the requirement of §5.203 with a chip antenna permanently attached to the transmitter.



5.2 Conducted Emission

The Line conducted emission test facility is inside a 4 m × 8 m × 2.5 m shielded enclosure. (FCC Registration No.: 100749)

The EUT was placed on a non-conducting 1.0 m by 1.5 m table, which is 0.8 m in height and 0.4 m away from the vertical wall of the shielded enclosure.

The EUT is powered from the Rohde & Schwarz LISN (ESH2-Z5) and the support equipment is powered from the Rohde & Schwarz LISN (ESH3-Z5). Powers to the LISN are filtered by high-current high insertion loss power line filter.

Sufficient time for EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition.

The RF output of the LISN was connected to the EMI test receiver (Rohde & Schwarz, ESCS30).

The EMI test receiver was scanned from 150 kHz to 30 MHz with 20 ms sweep time to determine the frequency producing the maximum EME from the EUT. The frequency producing the maximum level was re-examined using Quasi-Peak mode of the EMI test receiver.

The bandwidth of Quasi-peak mode was set to 9 kHz. Each emission was maximized consistent with typical applications by varying the configuration of the test sample. Interface cables were connected to the available interface ports of the test unit. The effect of varying the position of cables was investigated to find the configuration that produces maximum diagram emission. Excess cable lengths were bundled at center with 30 cm ~ 40 cm.

Each EME reported was calibrated using the R/S signal generator

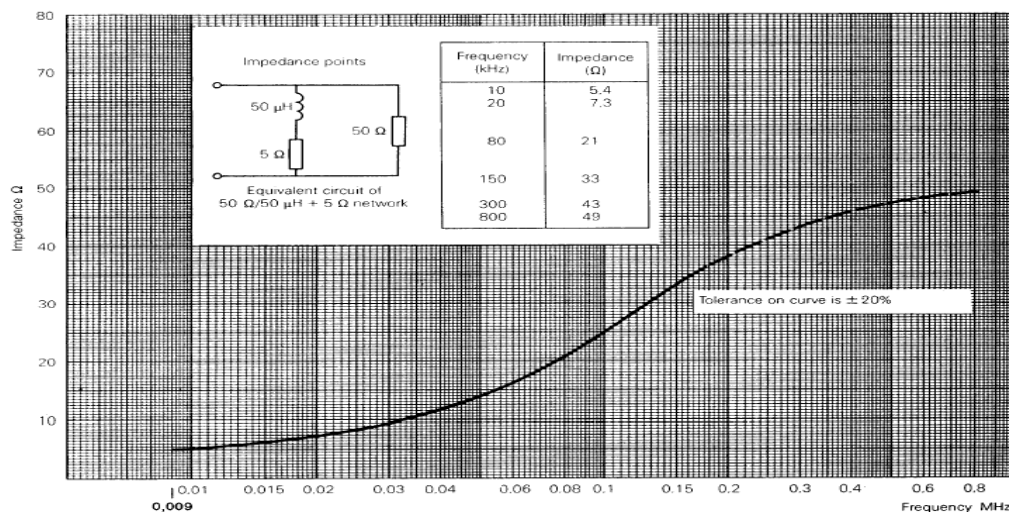


Fig 2. Impedance of LISN



5.3 Radiated Emission

Preliminary measurements were conducted 3 m semi anechoic chamber using broadband antennas to determine the frequency producing the maximum EME. Appropriate precaution was taken to ensure that all EME from the EUT were maximized and investigated. The technology configuration, mode of operation and turntable azimuth with respect to antenna was note for each frequency found.

Final measurements were made 3 m chamber (FCC registration No.: 443957) and/or 10 m OATS (FCC registration No.: 100749).

Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition.

Each frequency found during pre-scan measurements was re-examined and investigated using EMI test receiver. The detector function was set to CISPR quasi-peak mode average mode and the bandwidth of the receiver was set to 120 kHz or 1 MHz depending on the frequency or type of signal.

The EUT, support equipment and interconnecting cables were reconfigured to the setup producing the maximum emission for the frequency and were placed on top of a 0.8 m high non-metallic 1.0 m × 1.5 m table.

The turntable containing the test sample was rotated; the antenna height was varied 1 to 4 meter and stopped at the azimuth or height producing the maximum emission.

Each EME reported was calibrated using the R/S signal generator

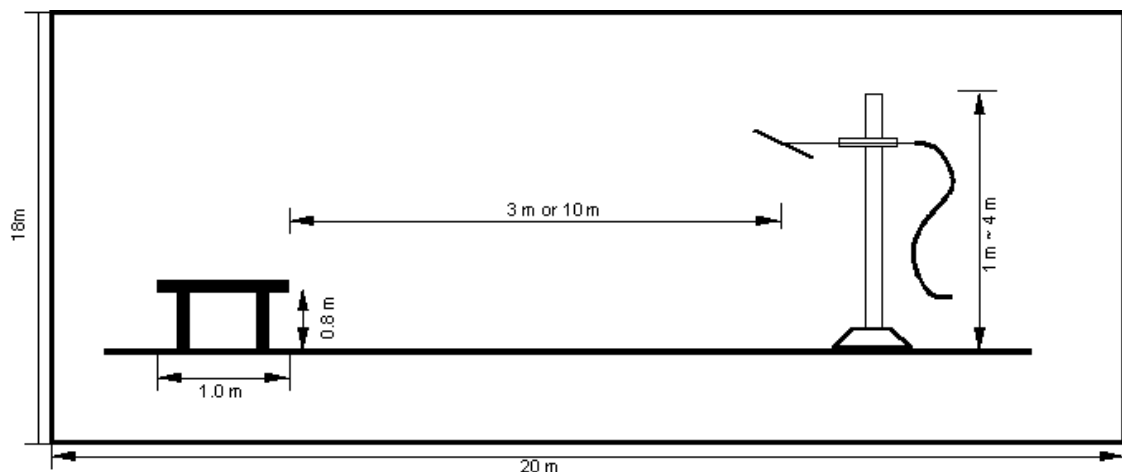


Fig 3. Dimensions of test site.

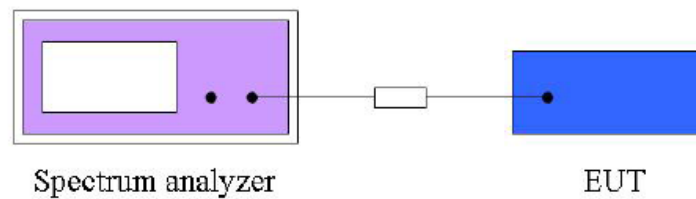


6. Number Of Hopping Frequency Used

6.1 Operating Environment

Temperature : 24.0 °C
Relative Humidity : 43.0 % R.H.

6.2 Test Set-up (Layout)



6.3 Limit

At least 15 channels frequencies, and should be equally spaced

6.4 Test Equipment used

Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ - ESIB26	Rohde & Schwarz	EMI Test Receiver	830482/010	12. 11. 2010

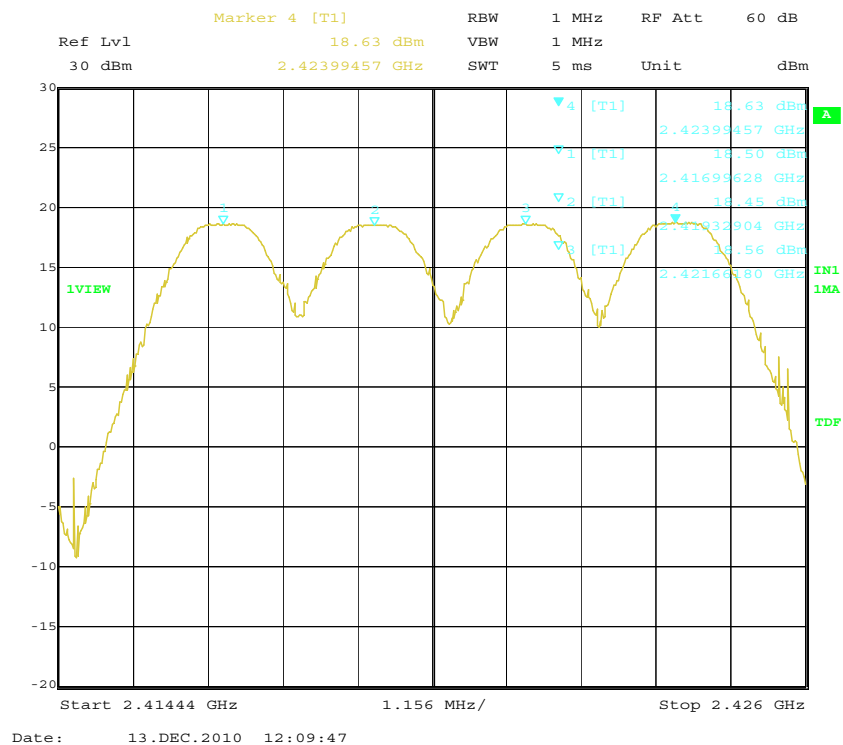
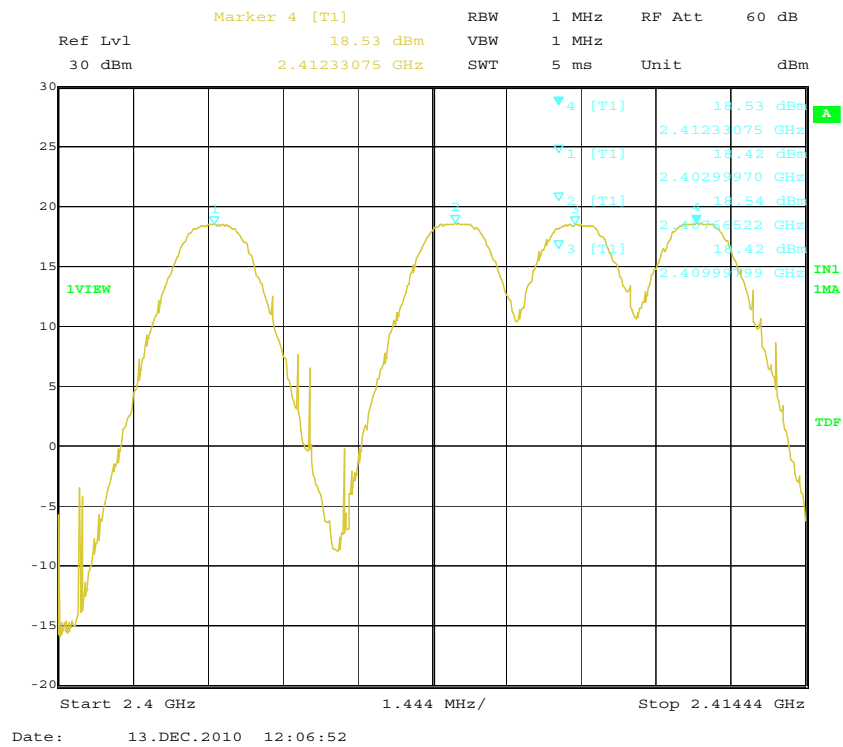
6.5 Test Result

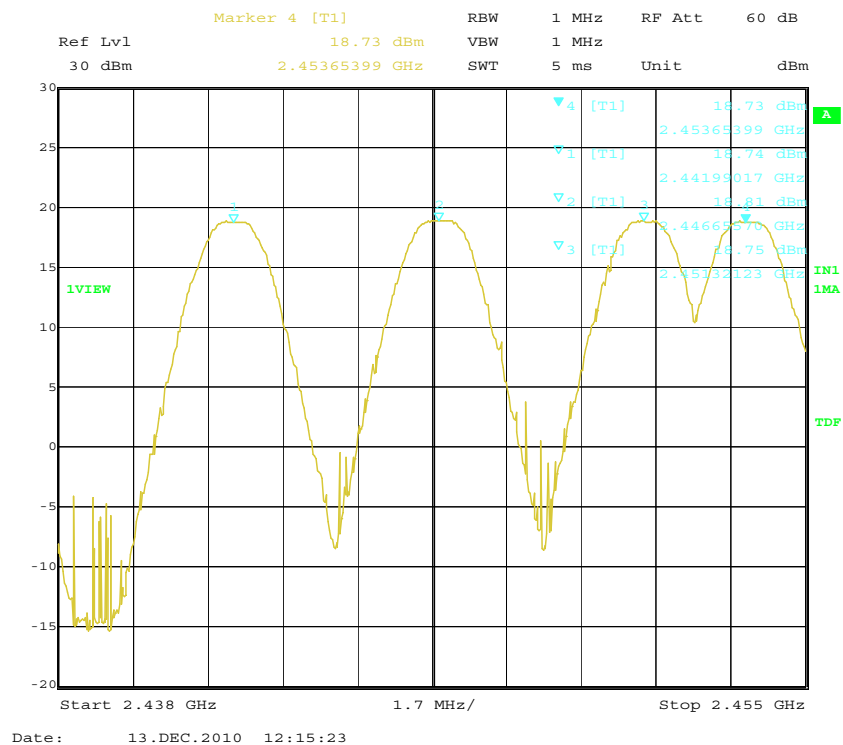
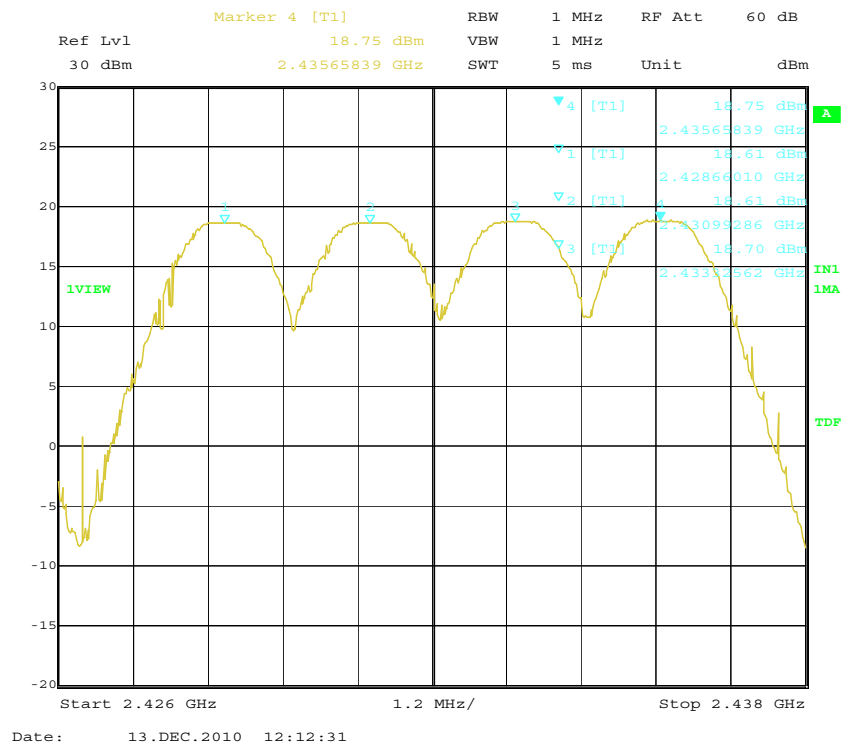
- Test Date : December 1, 2010
- Reference Standard : Part 15 Subpart C, Sec. 15.247(a)(1)(iii)
- Modulation : GFSK
- Operating Condition : RF transmitting mode
- Power Source : DC 4.8 V supplied from the nickel cadmium battery

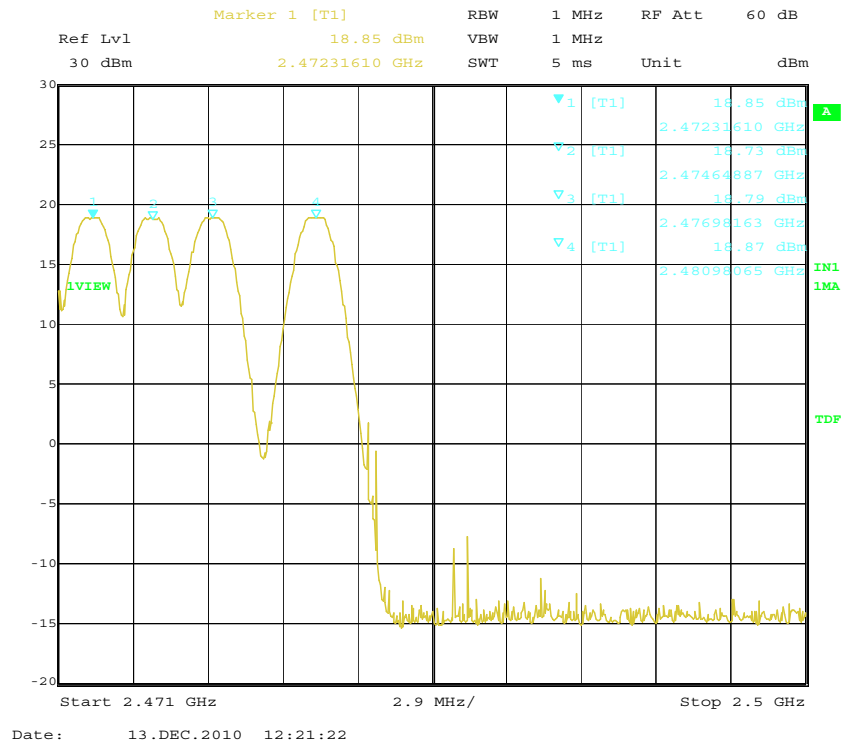
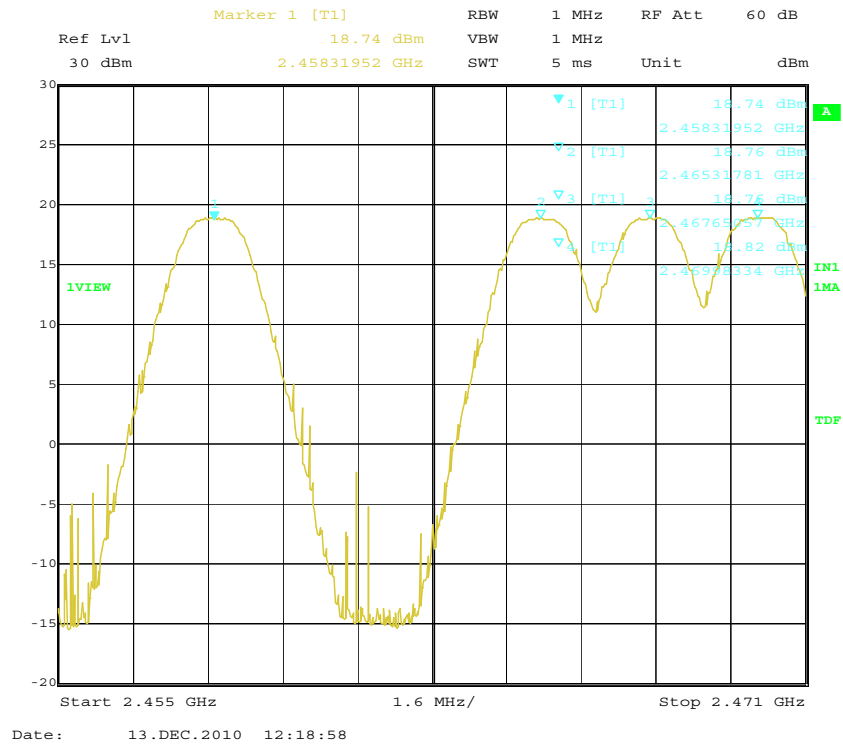
Modulation	Total channel No.	Hopping channel No.	Limit	Result
GFSK	235	24	> 15	Complies



Number of Hopping frequency used Plot on Configuration GFSK







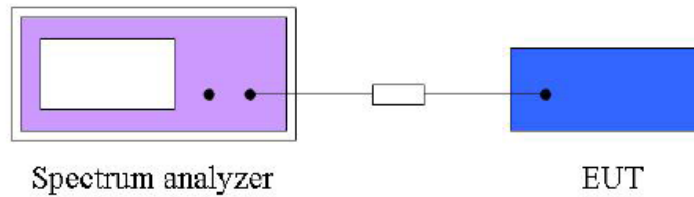


7. Dwell Time On Each Channel

7.1 Operating Environment

Temperature : 24.0 °C
Relative Humidity : 43.0 % R.H.

7.2 Test Set-up (Layout)



7.3 Limit

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

7.4 Test Equipment used

Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ - ESIB26	Rohde & Schwarz	EMI Test Receiver	830482/010	12. 11. 2010

7.5 Test Result

- Test Date : December 1, 2010
- Reference Standard : Part 15 Subpart C, Sec. 15.247(a)(1)(iii)
- Modulation : GFSK
- Operating Condition : RF transmitting mode
- Power Source : DC 4.8 V supplied from the nickel cadmium battery

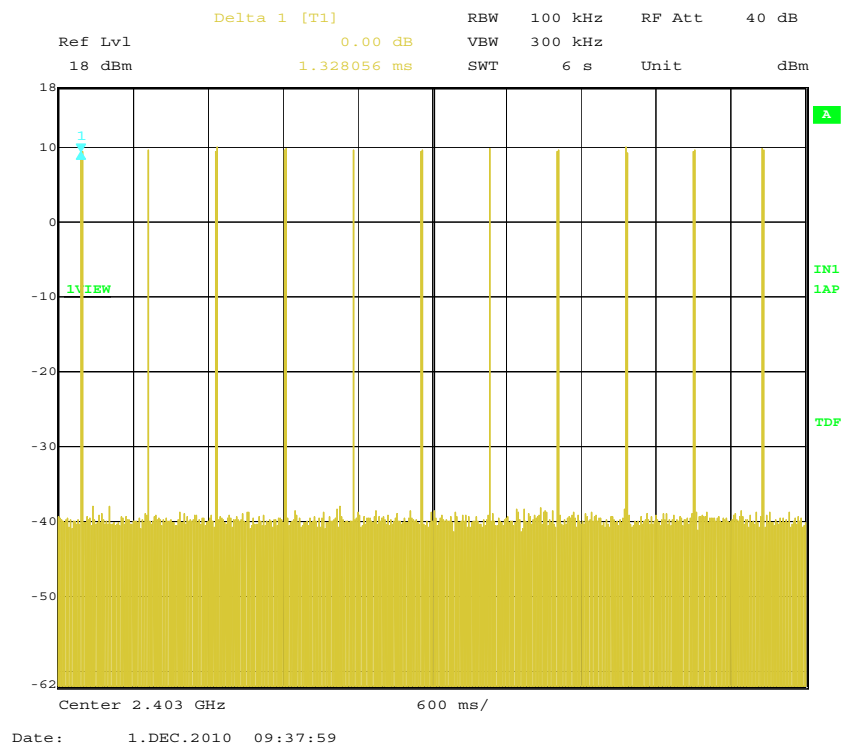
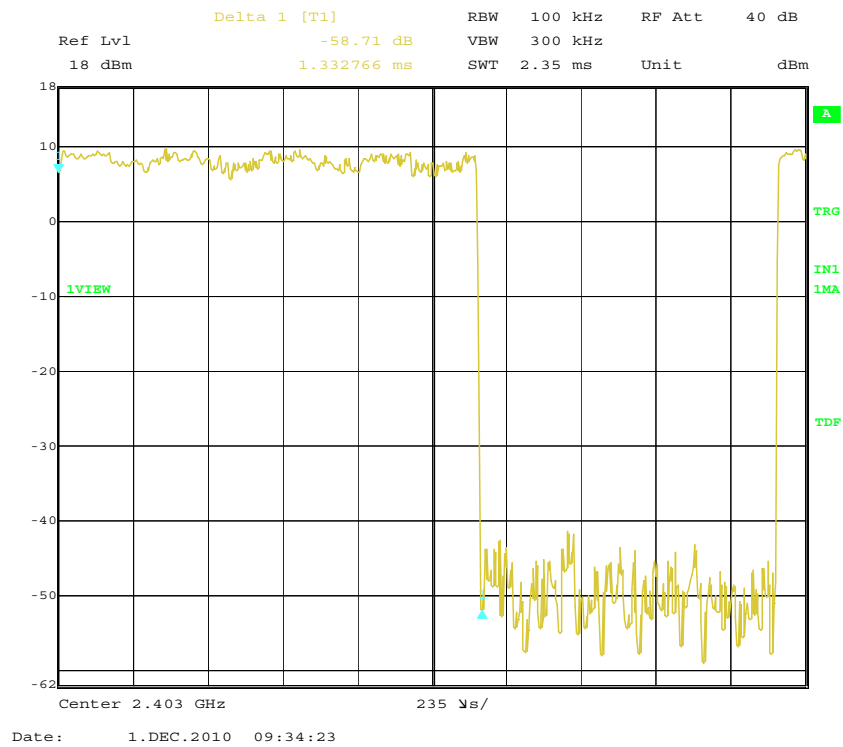
Spectrum Parameter

- Attenuation : Auto
- Span frequency : zero
- Resolution band width : 100 kHz
- Video band with : 300 kHz
- Sweep time : 6 s

Mode	Number of transmission in a 9.6 (24 Hopping * 0.4)	Length of transmission time (ms)	Measured (ms)	Limit (ms)	Result
GFSK	19 (times / 6 s) * 1.6 = 30.4	1.33	40.432	400	Complies



Dwell time on each time used Plot on Configuration GFSK



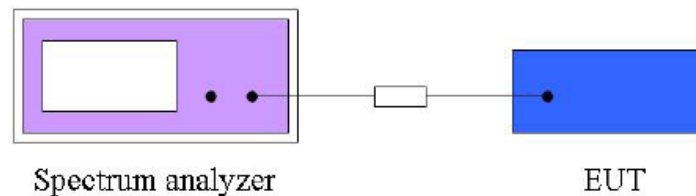


8. CHANNEL BANDWIDTH

8.1 Operating environment

Temperature : 24.0 °C
Relative Humidity : 44.0 % R.H.

8.2 Test Set-up (Layout)



8.3 Limit

For frequency hopping system operating in the 2 400 MHz ~ 2 483.5 MHz, If the 20 dB bandwidth of hopping channel is greater than 25 kHz, two-thirds 20 dB bandwidth of hopping channel shall be a minimum limit for the hopping channel separation.

8.4 Test Equipment used

Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ - ESIB26	Rohde & Schwarz	EMI Test Receiver	830482/010	12. 11. 2010

8.5 Test result

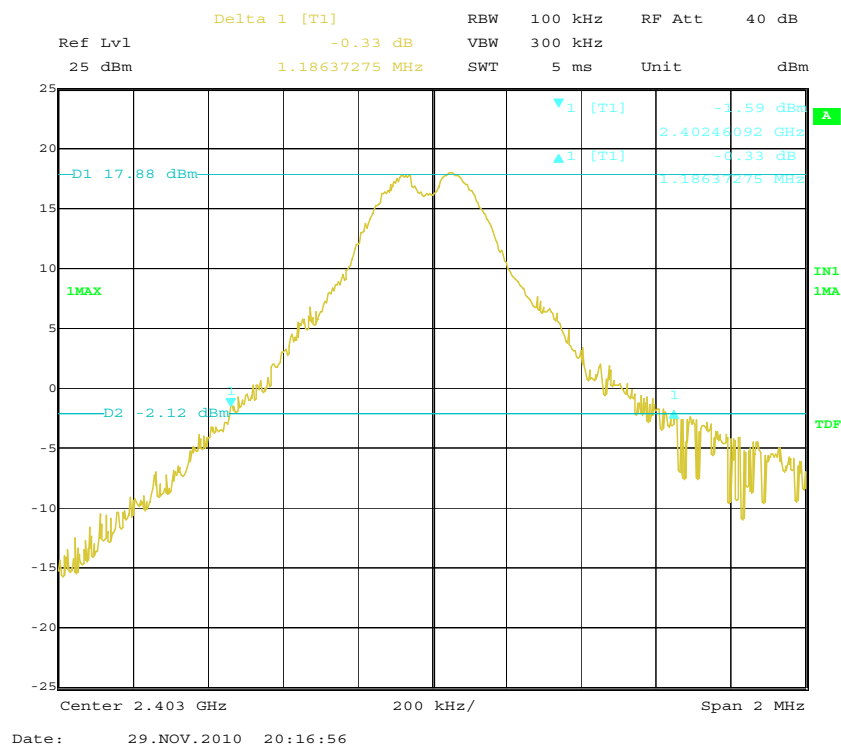
- Test Date : November 29, 2010
 - Reference Standard : Part 15 Subpart C, Sec. 15.247(a)(1)(iii)
 - Modulation : GFSK
 - Operating Condition : RF transmitting mode
 - Power Source : DC 4.8 V supplied from the nickel cadmium battery

Spectrum Parameter

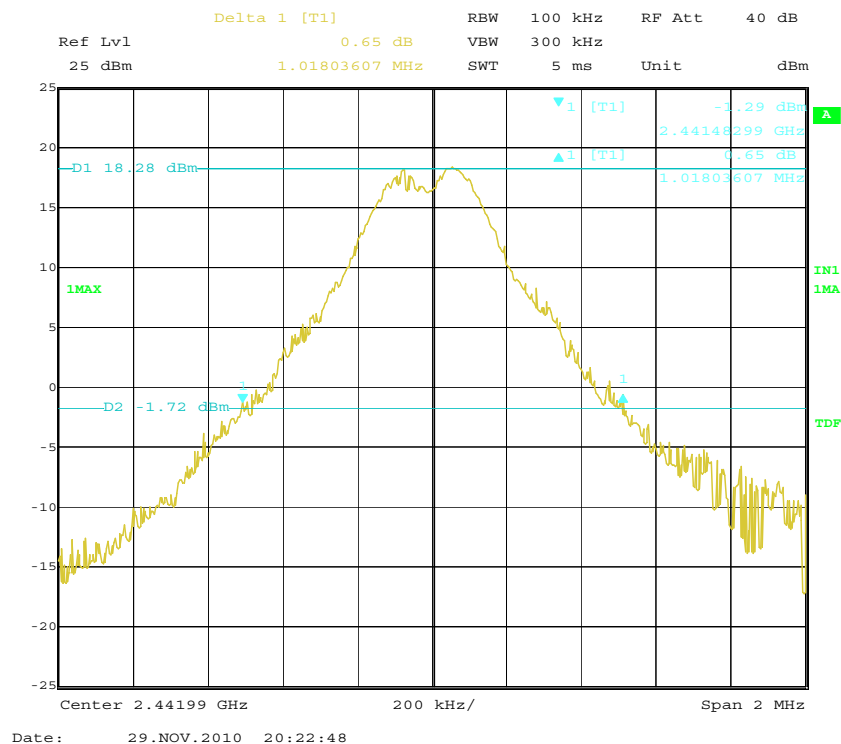
- Attenuation : Auto
 - Span frequency : zero
 - Resolution band width : 100 kHz
 - Video band with : 300 kHz
 - Sweep time : 5 ms

Channel	Channel frequency (MHz)	20 dB bandwidth (MHz)	Result
0	2 402.999 695	1.186	Complies
117	2 441.990 174	1.018	Complies
234	2 480.980 652	1.042	Complies

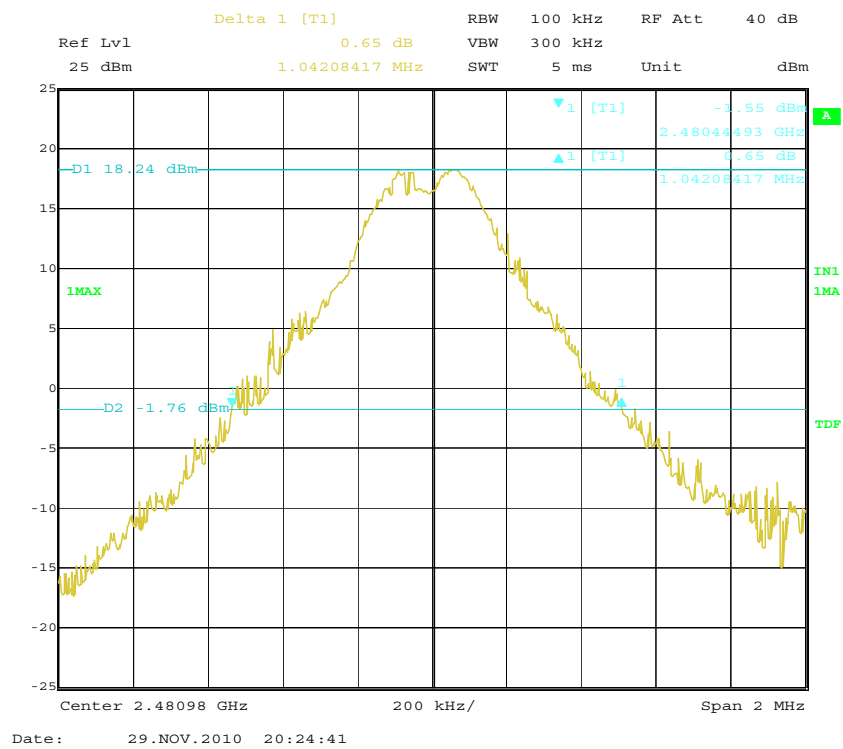
Channel bandwidth used Plot on Configuration GFSK/0 CH (2 402.999 695 MHz)



Channel bandwidth used Plot on Configuration GFSK/117 CH (2 441.990 174 MHz)



Channel bandwidth used Plot on Configuration GFSK/234 CH (2 480.980 652 MHz)



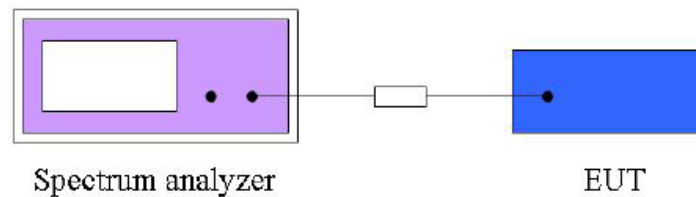


9. LIMIT OF HOPPING CHANNEL SEPARATION

9.1 Operating Environment

Temperature : 24.0 °C
Relative Humidity : 44.0 % R.H.

9.2 Test Set-up (Layout)



9.3 Limit

For frequency hopping system operating in the 2 400 MHz ~ 2 483.5 MHz, If the 20 dB bandwidth of hopping channel is greater than 25 kHz, two-thirds 20 dB bandwidth of hopping channel shall be a minimum limit for the hopping channel separation.

9.4 Test Equipment used

Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ - ESIB26	Rohde & Schwarz	EMI Test Receiver	830482/010	12. 11. 2010

9.5 Test Result

- Test Date : November 29, 2010
- Reference Standard : Part 15 Subpart C, Sec. 15.247(a)(1)
- Modulation : GFSK
- Operating Condition : RF transmitting mode
- Power Source : DC 4.8 V supplied from the nickel cadmium battery

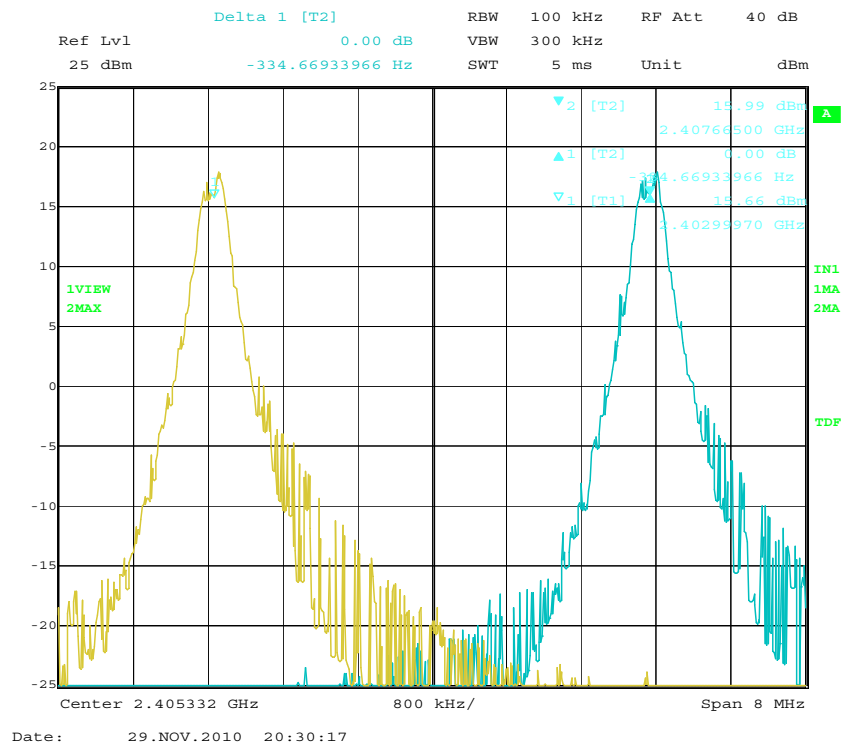
Spectrum Parameter

- Attenuation : Auto
- Span frequency : 8 MHz
- Resolution band width : 100 kHz
- Video band with : 300 kHz
- Sweep time : 5 ms

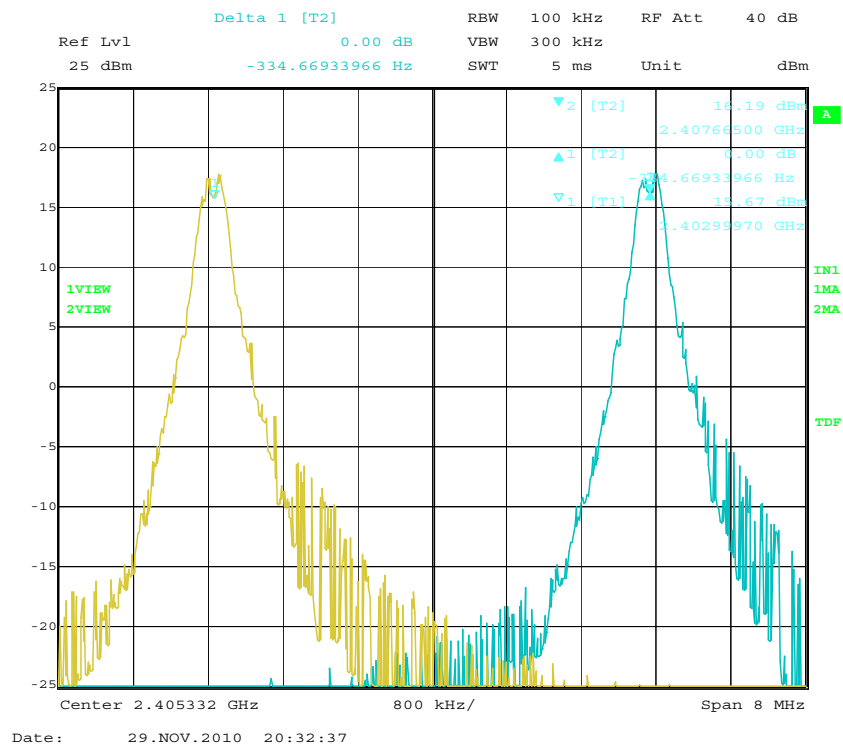
Channel	Channel frequency (MHz)	Adjacent channel Separation (MHz)	Limit (MHz) [2/3 of 20 dB bandwidth]	Result
0	2 402.999 695	4.66	> 0.848	Complies
117	2 441.990 174	4.66	> 0.831	Complies
234	2 480.980 652	3.99	> 0.838	Complies



Channel separation used Plot on Configuration GFSK/0 CH (2 402.999 695 MHz)

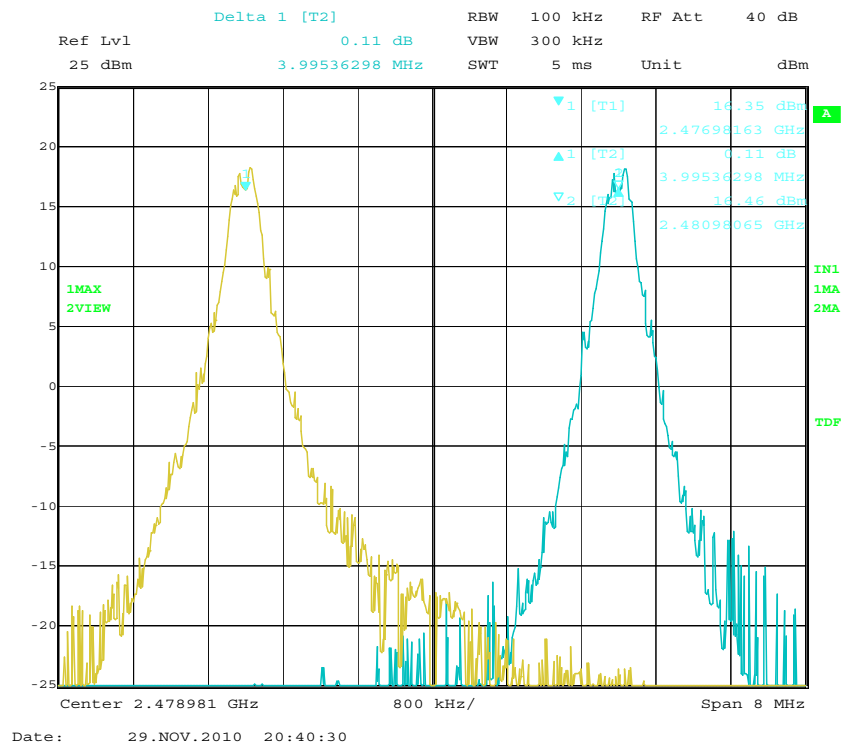


Channel separation used Plot on Configuration GFSK/117 CH (2 441.990 174 MHz)





Channel separation used Plot on Configuration GFSK/234 CH (2 480.980 652 MHz)



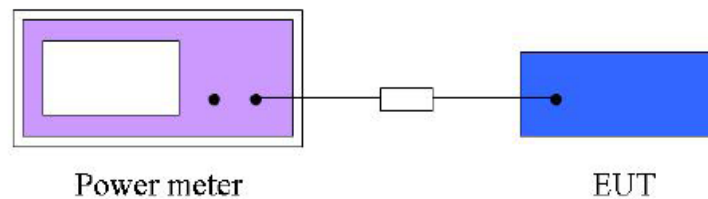


10. MAXIMUM PEAK OUTPUT POWER

10.1 Operating Environment

Temperature : 24.0 °C
Relative Humidity : 43.0 % R.H.

10.2 Test Set-up (Layout)



10.3 Limit

The maximum peak output power measurement is 125 mW

10.4 Test Equipment used

Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ - NRVD	Rohde & Schwarz	Power meter	837794/048	12.11.2010
■ - NRV-Z32	Rohde & Schwarz	Power sensor	100062	10.20.2011

10.5 Test Result

- Test Date : December 1, 2010
- Reference Standard : Part 15 Subpart C, Sec. 15.247(b)
- Modulation : GFSK
- Operating Condition : RF transmitting mode
- Power Source : DC 4.8 V supplied from the nickel cadmium battery

Channel	Channel Frequency (MHz)	Peak output power (dBm)	Peak output power (mW)	Limit (mW)	Result
0	2 402.999 695	17.99	63.0	125	Complies
117	2 441.990 174	18.53	71.3	125	Complies
234	2 480.980 652	18.65	73.4	125	Complies

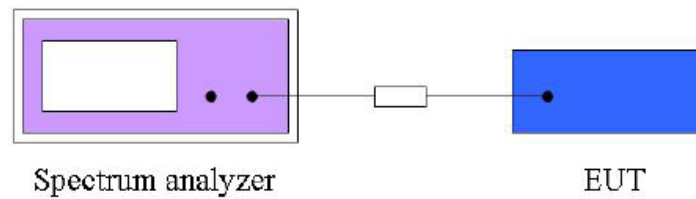


11. BAND EDGES MEASUREMENT

11.1 Operating Environment

Temperature : 24.0 °C
Relative Humidity : 43.0 % R.H.

11.2 Test Set-up (Layout)



11.3 Limit

Below -20 dB of the highest emission level of operating band (in 100 kHz resolution band width)

11.4 Test Equipment used

Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ - ESIB26	Rohde & Schwarz	EMI Test Receiver	830482/010	12. 11. 2010

11.5 Test Result

- Test Date : November 10, 2010
- Reference Standard : Part 15 Subpart C, Sec. 15.247(b)
- Modulation : GFSK
- Operating Condition : RF transmitting mode
- Power Source : DC 4.8 V supplied from the nickel cadmium battery

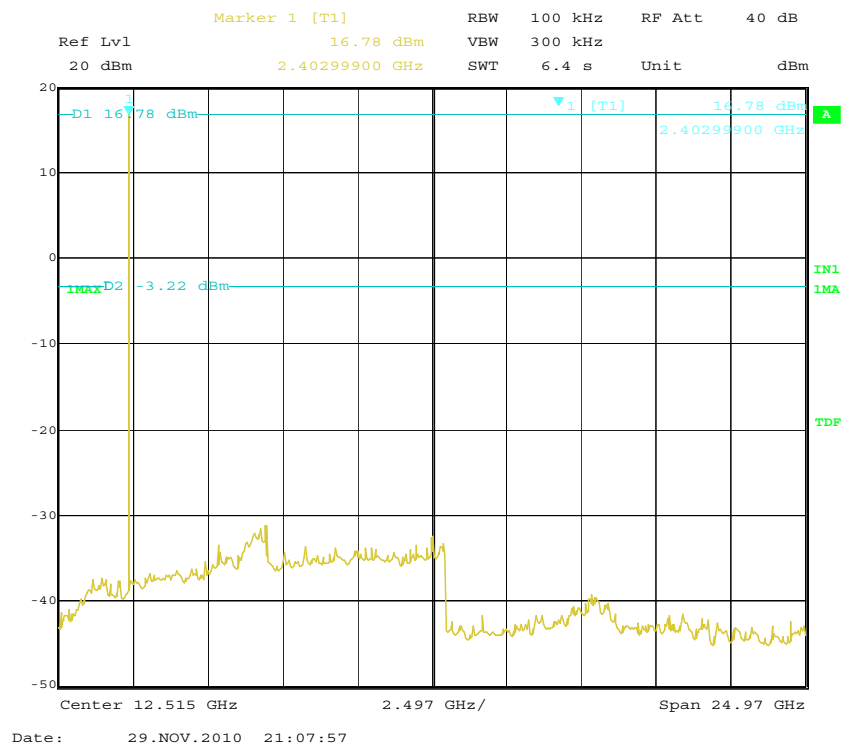
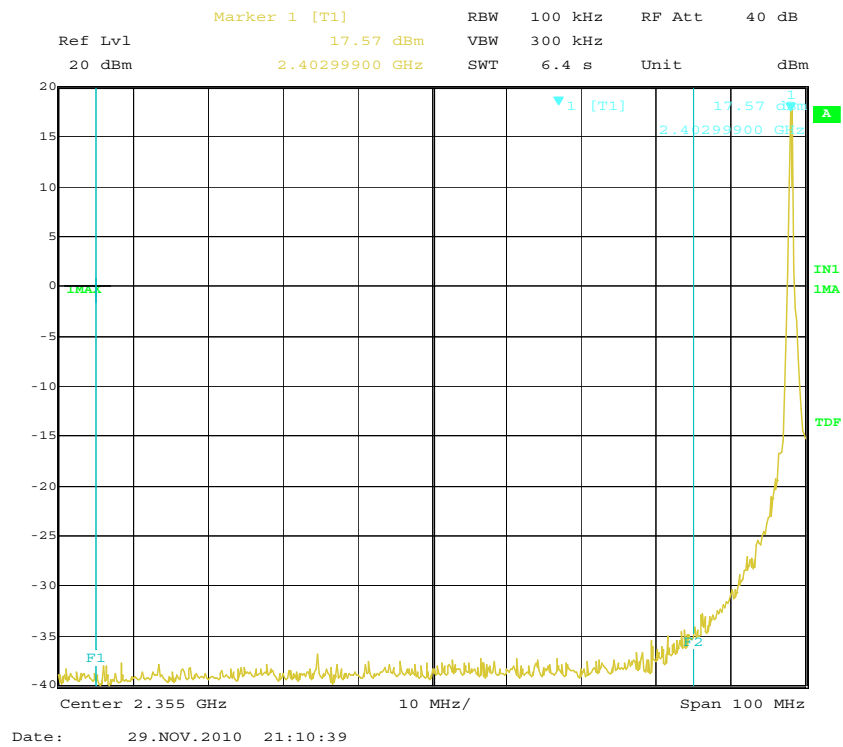
The spectrum plots are attached on the following 8 images, D1 line indicates the highest level, D2 line indicates the 20 dB offset below D1. It shows compliance with the requirement in part 15.247(d)

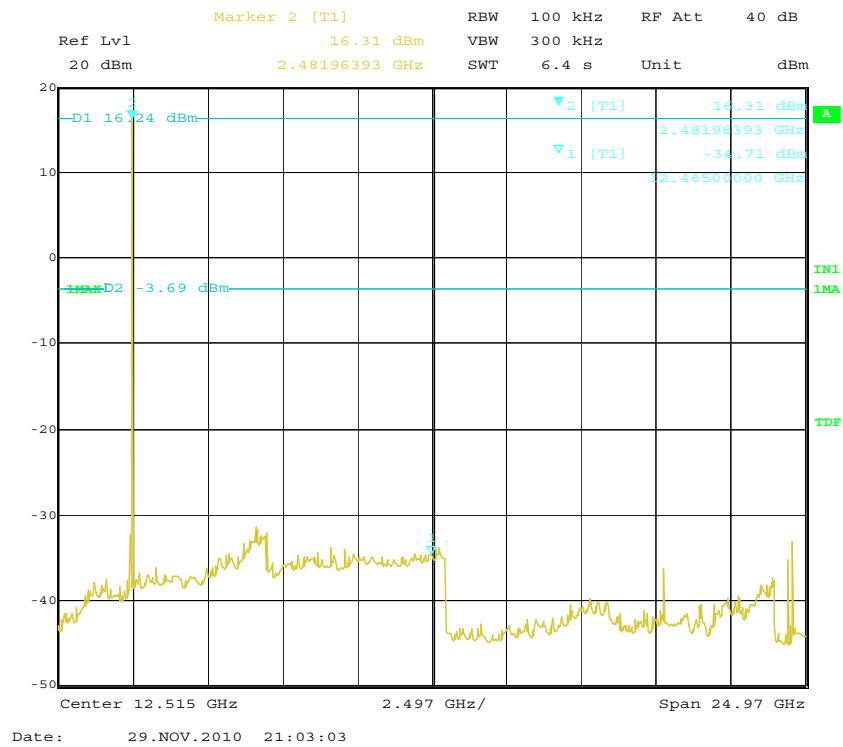
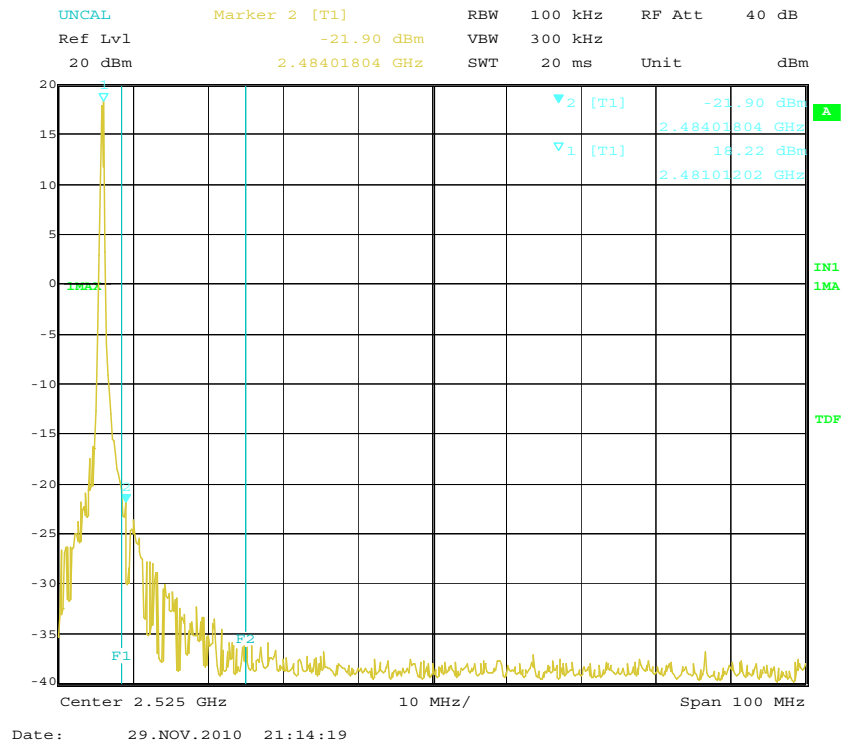
Spectrum Parameter

- Attenuation : Auto
- Resolution bandwidth : 100 kHz
- Video bandwidth : 100 kHz



Band edge used Plot on Configuration GFSK







12. Radiated Emission

12.1 Operating Environment

Temperature : 24.0 °C
Relative Humidity : 43.0 % R.H.

12.2 Test Set-up

The formal radiated emission was measured at 3 m distance anechoic chamber.

The EUT was placed on a non-conductive turntable approximately 0.8 m above the ground plane.

The turntable with EUT was rotated 360°, and the antenna was varied in height between 1.0 m and 4.0 m in order to determine the maximum emission levels.

This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

12.3 Measurement Uncertainty

The measurement uncertainty was calculated in accordance with ISO “Guide to the expression of uncertainty in measurement”.

The measurement uncertainty was given with a confidence of 95 %.

Test Items	Uncertainty	Remark
Radiated emission (30 MHz ~ 300 MHz, 3 m, Vertical)	± 4.09 dB	Confidence levels of 95 % ($k = 2$)
Radiated emission (30 MHz ~ 300 MHz, 3 m, Horizontal)	± 3.78 dB	Confidence levels of 95 % ($k = 2$)
Radiated emission (300 MHz ~ 1 000 MHz, 3 m, Vertical)	± 3.85 dB	Confidence levels of 95 % ($k = 2$)
Radiated emission (300 MHz ~ 1 000 MHz, 3 m, Horizontal)	± 4.11 dB	Confidence levels of 95 % ($k = 2$)

12.4 Limit

20 dB in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a) limit in the table below has to be followed.

Frequencies (MHz)	Field Strength (microvolt/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2400/F (kHz)	300
0.490 ~ 1.705	2400/F (kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3



12.5 Test Equipment used

Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ - ESIB26	Rohde & Schwarz	EMI Test Receiver	830482/010	12. 11. 2010
■ - VULB9160	Schwarzbeck	Broadband test antenna	3193	03. 15. 2012
■ - MCU066	maturo GmbH	Position Controller	1390306	N/A
■ - TT2.5SI	maturo GmbH	Turntable	1390307	N/A
■ - AM4.0	maturo GmbH	Antenna Mast	1390308	N/A
■ - BBHA9120D	Schwarzbeck	Horn antenna	207	12. 22. 2011
■ - 3160-09	ETS LINDGREN	Horn antenna	LM3423	04. 06. 2011
■ - AFS44-00101800-25-10P-44	MITEQ	Preamplifier	1258942	11. 12. 2011
■ - AFS44-00101800-25-10P-44	MITEQ	Preamplifier	1258943	11. 12. 2011

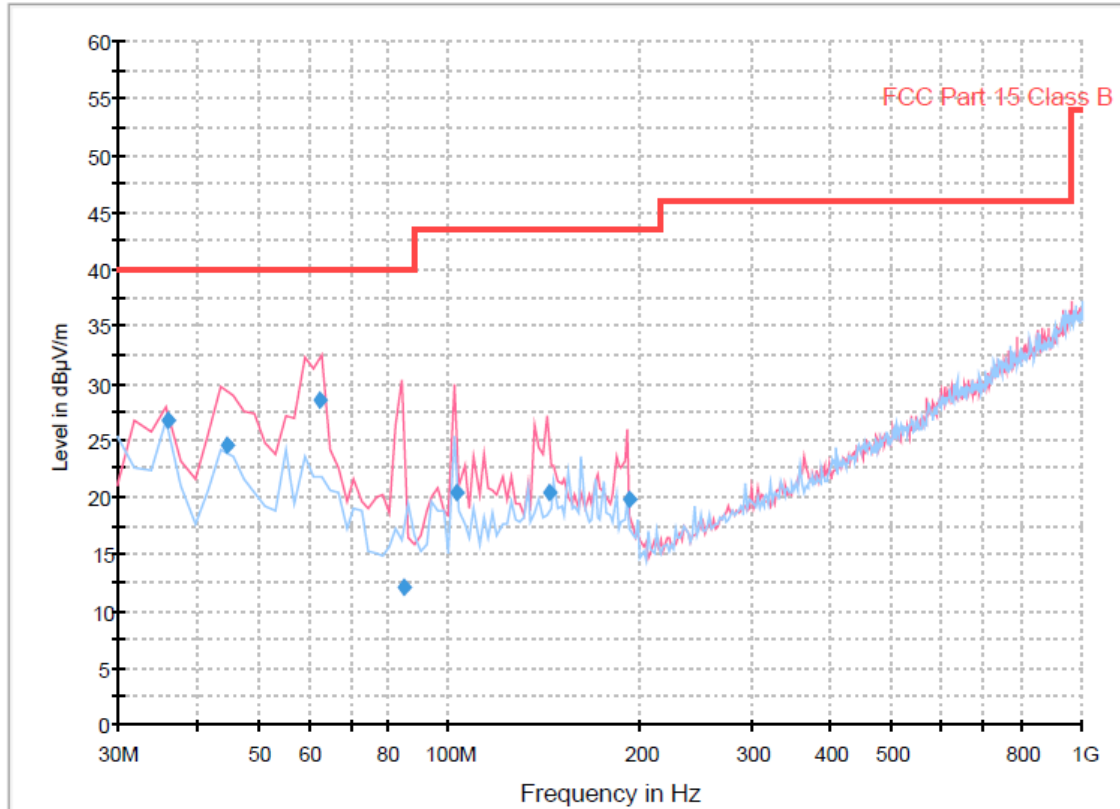
12.6 Radiated emission test data

- Test Date	: November 30, 2010
- Reference Standard	: Part 15 Subpart C, Sec. 15.247(d)
- Modulation / Channel	: GFSK (0 CH / 117 CH / 234 CH)
- Operating Condition	: RF transmitting mode
- Measuring Distance	: 3 m
- Spectrum Resolution Bandwidth(6 dB)	: 120 kHz / 1 MHz / 10 Hz / 100 kHz
- Detector mode	: Peak detector mode / Quasi Peak detector mode / Average detector mode
- Power Source	: DC 4.8 V supplied from the nickel cadmium battery
- Note	: 1. The EUT was tested with new battery. 2. Through three orthogonal axes were investigated and the worst case is report



Worst case result of radiated emission (30 MHz to 1 000 MHz): GFSK

Radiated Emission_below 1 GHz

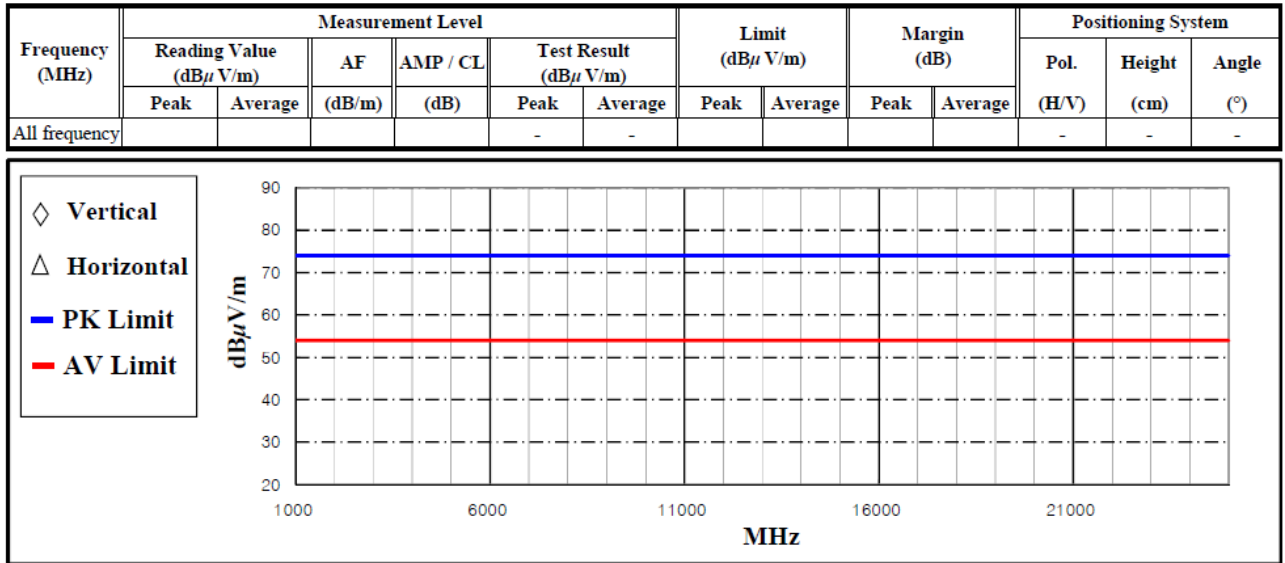


Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
35.971663	26.8	1000.0	120.000	100.0	V	350.0	13.0	13.2	40.0
44.587214	24.5	1000.0	120.000	100.0	V	95.0	13.4	15.5	40.0
62.666092	28.5	1000.0	120.000	100.0	V	332.0	13.0	11.5	40.0
85.008858	12.2	1000.0	120.000	100.0	V	191.0	9.8	27.8	40.0
103.103848	20.3	1000.0	120.000	157.0	V	262.0	11.6	23.2	43.5
144.005491	20.3	1000.0	120.000	100.0	V	112.0	14.9	23.2	43.5
192.162685	19.9	1000.0	120.000	100.0	V	78.0	12.8	23.6	43.5



Worst case result of radiated emission (1 GHz to 25 GHz): GFSK



*Comment : AMP/CL_Cable loss value + AMP gain value
AF : Antenna factor value
Pol. : H(Horizontal), V(Vertical)

Result of radiated emission (Band Edge)

0 CH

Frequency (MHz)	Measurement Level						Limit (dBμ V/m)		Margin (dB)		Positioning System		
	Reading Value (dBμ V)		AF	AMP / CL	Test Result (dBμ V/m)						Pol.	Height	Angle
	Peak	Average	(dB/m)	(dB)	Peak	Average	Peak	Average	Peak	Average	(H/V)	(cm)	(°)
2402.99	115.42	103.62	26.99	-36.91	105.50	93.70	74.00	54.00	-	-	-	-	-
2386.77	76.29	50.09	26.95	-36.94	66.30	40.10	74.00	54.00	7.70	13.90	-	-	-

234 CH

Frequency (MHz)	Measurement Level						Limit (dBμ V/m)		Margin (dB)		Positioning System		
	Reading Value (dBμ V)		AF	AMP / CL	Test Result (dBμ V/m)						Pol.	Height	Angle
	Peak	Average	(dB/m)	(dB)	Peak	Average	(H/V)	(cm)	(°)				
2480.98	111.79	104.29	27.20	-36.79	102.20	94.70	74.00	54.00	-	-	-	-	
2483.50	72.47	49.77	27.21	-36.78	62.90	40.20	74.00	54.00	11.10	13.80	-	-	

Note:

The amplitude of spurious emissions that are attenuated by more than 20dB below the permissible value has no need to be reported.

Emission level (dBμV/m) = 20 log Emission level (μV/m).

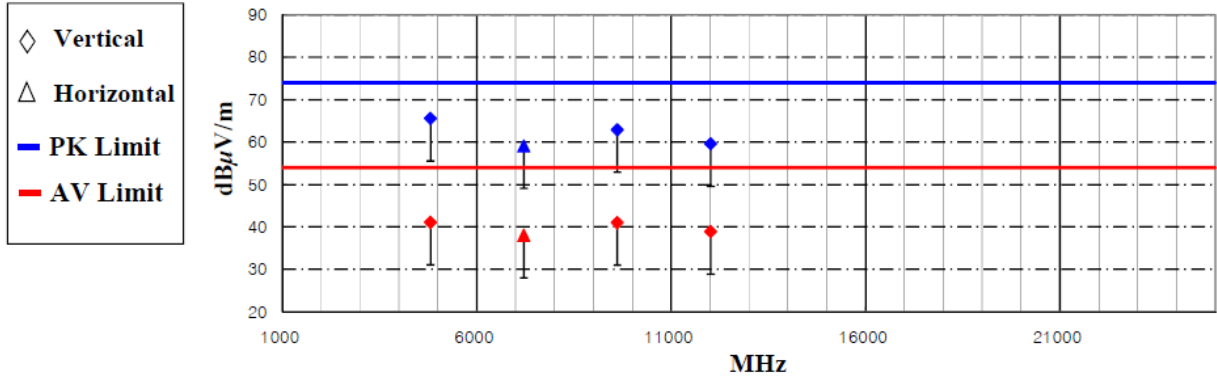
Corrected reading: Antenna factor + Cable loss + Preamplifier gain + Read value = Test result



Result of radiated emission (1 GHz to 10th harmonics)

(GFSK, 0 CH / 2 402.999 695 MHz)

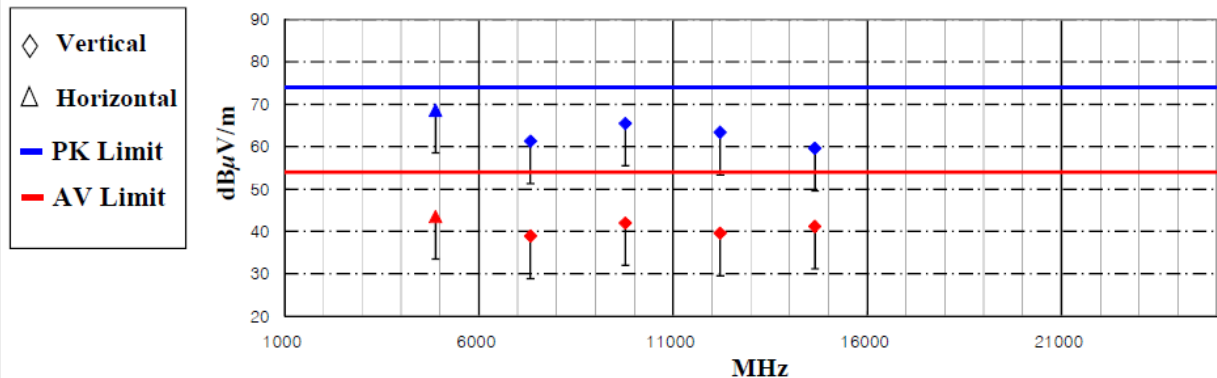
Frequency (MHz)	Measurement Level						Limit (dB μ V/m)		Margin (dB)		Positioning System		
	Reading Value (dB μ V/m)		AF	AMP / CL	Test Result (dB μ V/m)						Pol.	Height	Angle
	Peak	Average	(dB/m)	(dB)	Peak	Average	Peak	Average	Peak	Average	(H/V)	(cm)	(°)
4806.21	67.23	42.73	31.20	-32.83	65.60	41.10	74.00	54.00	8.40	12.90	V	183	50
7209.42	50.74	29.64	35.75	-27.39	59.10	38.00	74.00	54.00	14.90	16.00	H	165	72
9612.22	46.82	24.92	38.77	-22.69	62.90	41.00	74.00	54.00	11.10	13.00	V	150	23
12015.04	42.15	21.45	39.26	-21.81	59.60	38.90	74.00	54.00	14.40	15.10	V	172	265



*Comment : AMP/CL_Cable loss value + AMP gain value
AF : Antenna factor value
Pol. : H(Horizontal), V(Vertical)

(GFSK, 117 CH / 2 441.990 174 MHz)

Frequency (MHz)	Measurement Level						Limit (dBμ V/m)		Margin (dB)		Positioning System		
	Reading Value (dBμ V/m)		AF	AMP / CL	Test Result (dBμ V/m)						Pol.	Height	Angle
	Peak	Average	(dB/m)	(dB)	Peak	Average	Peak	Average	Peak	Average	(H/V)	(cm)	(°)
4883.93	70.03	44.93	31.34	-32.77	68.60	43.50	74.00	54.00	5.40	10.50	H	163	89
7326.46	52.50	30.10	35.97	-27.17	61.30	38.90	74.00	54.00	12.70	15.10	V	155	82
9767.72	48.79	25.29	39.03	-22.32	65.50	42.00	74.00	54.00	8.50	12.00	V	150	45
12209.85	45.84	22.04	39.21	-21.65	63.40	39.60	74.00	54.00	10.60	14.40	V	196	271
14652.32	37.91	19.51	42.68	-20.99	59.60	41.20	74.00	54.00	14.40	12.80	V	143	65

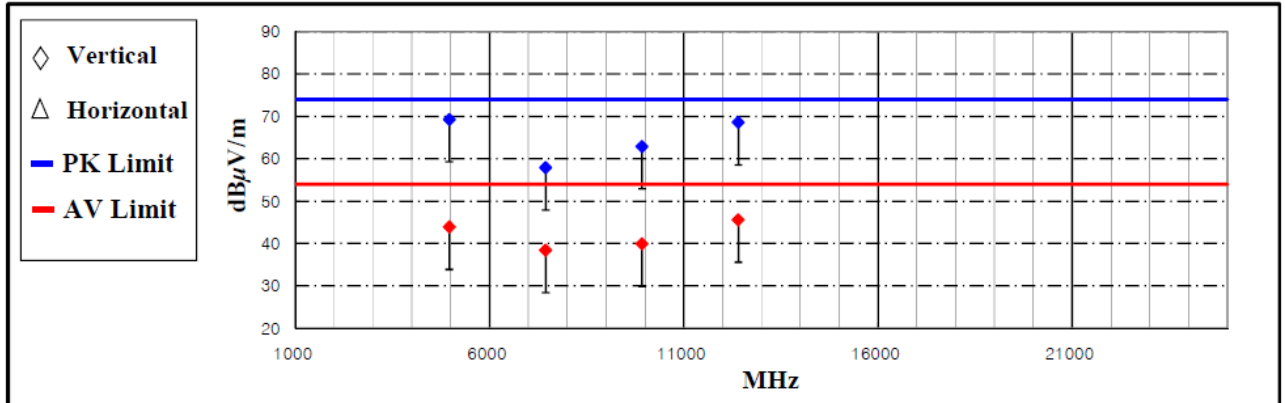


*Comment : AMP/CL_Cable loss value + AMP gain value
AF : Antenna factor value
Pol. : H(Horizontal), V(Vertical)



(GFSK, 234 CH / 2 480.980 652 MHz)

Frequency (MHz)	Measurement Level						Limit (dBμ V/m)		Margin (dB)		Positioning System		
	Reading Value (dBμ V/m)		AF	AMP / CL	Test Result (dBμ V/m)						Pol.	Height	Angle
	Peak	Average	(dB/m)	(dB)	Peak	Average	Peak	Average	Peak	Average	(H/V)	(cm)	(°)
4962.11	70.52	45.12	31.48	-32.70	69.30	43.90	74.00	54.00	4.70	10.10	V	139	294
7442.69	48.65	29.15	36.19	-26.94	57.90	38.40	74.00	54.00	16.10	15.60	V	142	116
9924.03	45.55	22.55	39.29	-21.94	62.90	39.90	74.00	54.00	11.10	14.10	V	139	36
12405.02	50.94	27.94	39.15	-21.49	68.60	45.60	74.00	54.00	5.40	8.40	V	181	307



*Comment : AMP/CL_Cable loss value + AMP gain value
AF : Antenna factor value
Pol. : H(Horizontal), V(Vertical)

Note:

Emission level (dBμV/m) = 20 log Emission level (μV/m).

Corrected Reading: Reading value + AF (Antenna Factor) +AMP/CL (Cable Loss + Preamp factor) = Test result