Section 15.247 Subclause (a) (1) (iii). Time of occupancy (Dwell Time)

SPECIFICATION

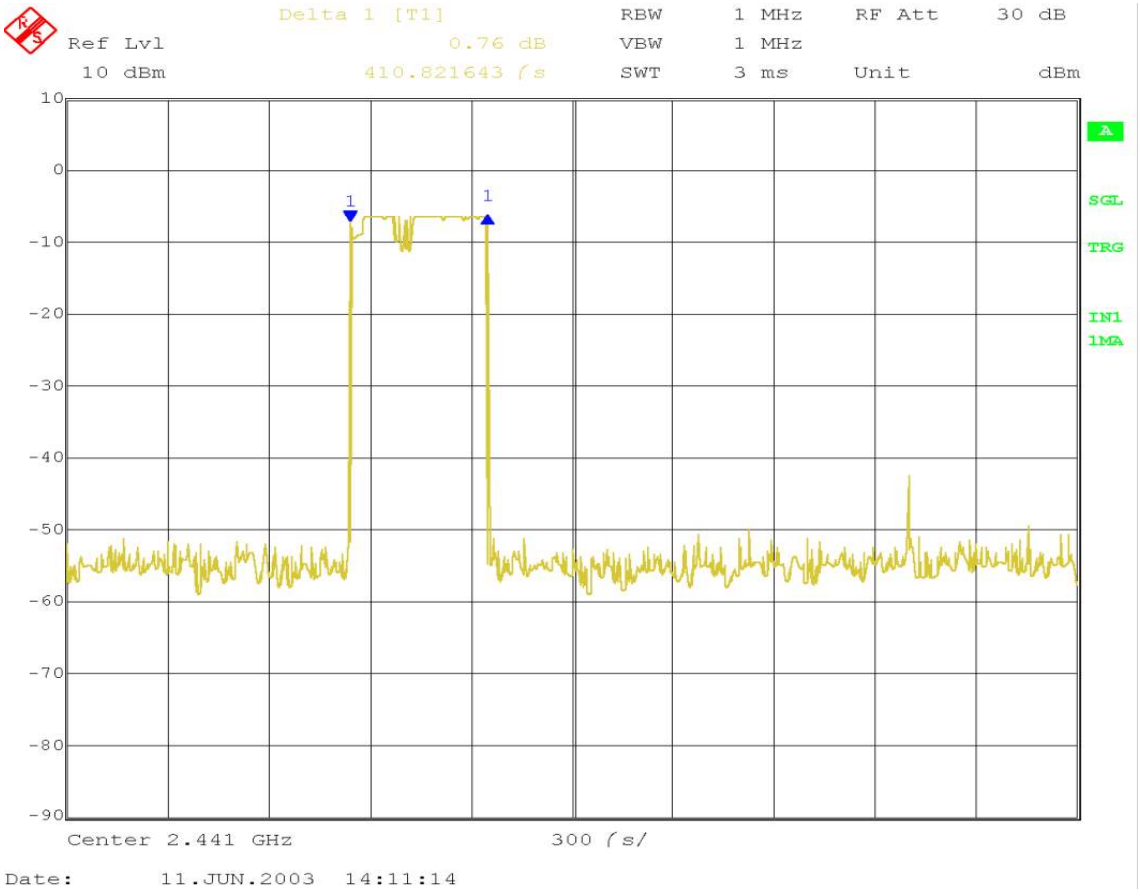
The average time of occupancy on any channel shall not be greater than 0.4 seconds (400 ms) within a period of 0.4 seconds multiplied by the number of hopping channels employed = 0.4 x 79= 31.6 seconds.

RESULTS

The equipment only supports 1 slot packet (DH1).

1. TIME OF OCCUPANCY (DWELL TIME) FOR PACKET TYPE DH1.

The system makes worst case 1600 hops per second or 1 time slot has a length of 625µs with 79 channels. A DH1 Packet need 1 time slot for transmitting and 1 time slot for receiving. Then the system makes worst case 1600/2 = 800 hops per second with 79 channels. So you have each channel 800/79 = 10.13 times per second and so for a period of 0.4 x 79 = 31.6 seconds you have 10.13 x 31.6 = 320.11 times of appearence .
Each Tx-time per appearence is 410.8 µs (see next plot).
So we have 320.11 x 410.8 µs = 131.50 ms per 31.6 seconds.



Verdict: PASS

Section 15.247 Subclause (b). Maximum peak output power and antenna gain

SPECIFICATION

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels: 1 watt (30 dBm).

RESULTS

MAXIMUM PEAK OUTPUT POWER (CONDUCTED). See next plots.

	Lowest frequency 2402 MHz	Middle frequency 2441 MHz	Highest frequency 2480 MHz
Maximum peak power (dBm)	0.92	0.11	-0.53
Measurement uncertainty (dB)	±1.5		

The maximum declared antenna gain for this device is 0 dBi, therefore the maximum theoretical peak radiated power (EIRP) in the three measurement channels for this device is 0.92 dBm or 1.23 mW.

The actual peak rediated power (EIRP) was measured for the lowest, middle and highest frequency (see next plots):

MAXIMUM PEAK OUTPUT POWER (RADIATED).

	Lowest frequency 2402 MHz	Middle frequency 2441 MHz	Highest frequency 2480 MHz
Instrument reading (dBm)	-35.64	-35.53	-38.50
Correction Factor (dB)	34.96	35.10	35.24
Maximum EIRP peak power (dBm)	-0.68	-0.43	-3.26
Measurement uncertainty (dB)	+1.98 / -1.75		

The antenna is integrated in the class 2 surface Bluetooth module.

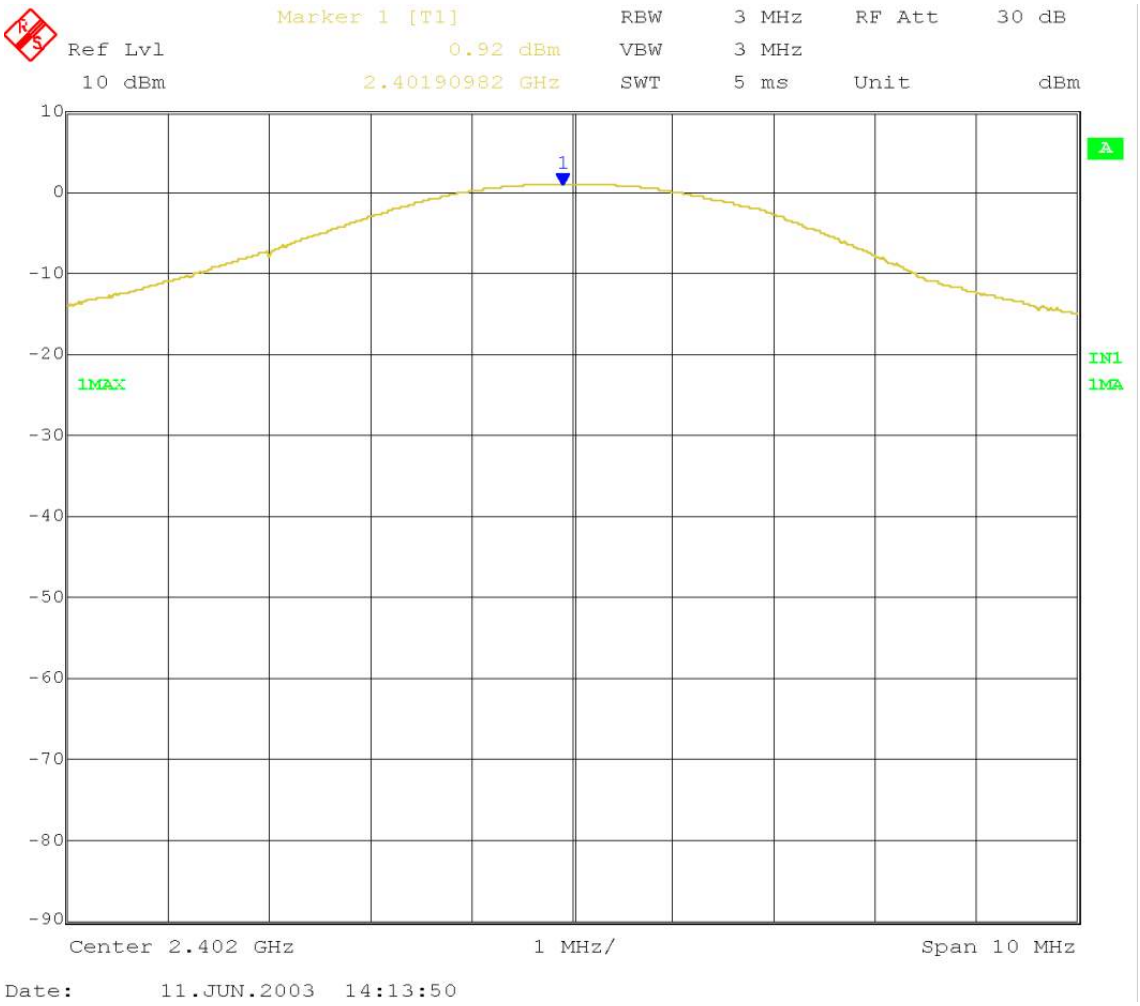
Declared peak gain: 0 dBi

The maximum directional gain of the antenna is less than 6 dBi and therefore the maximum output power is not required to be reduced from the stated values.

Verdict: PASS

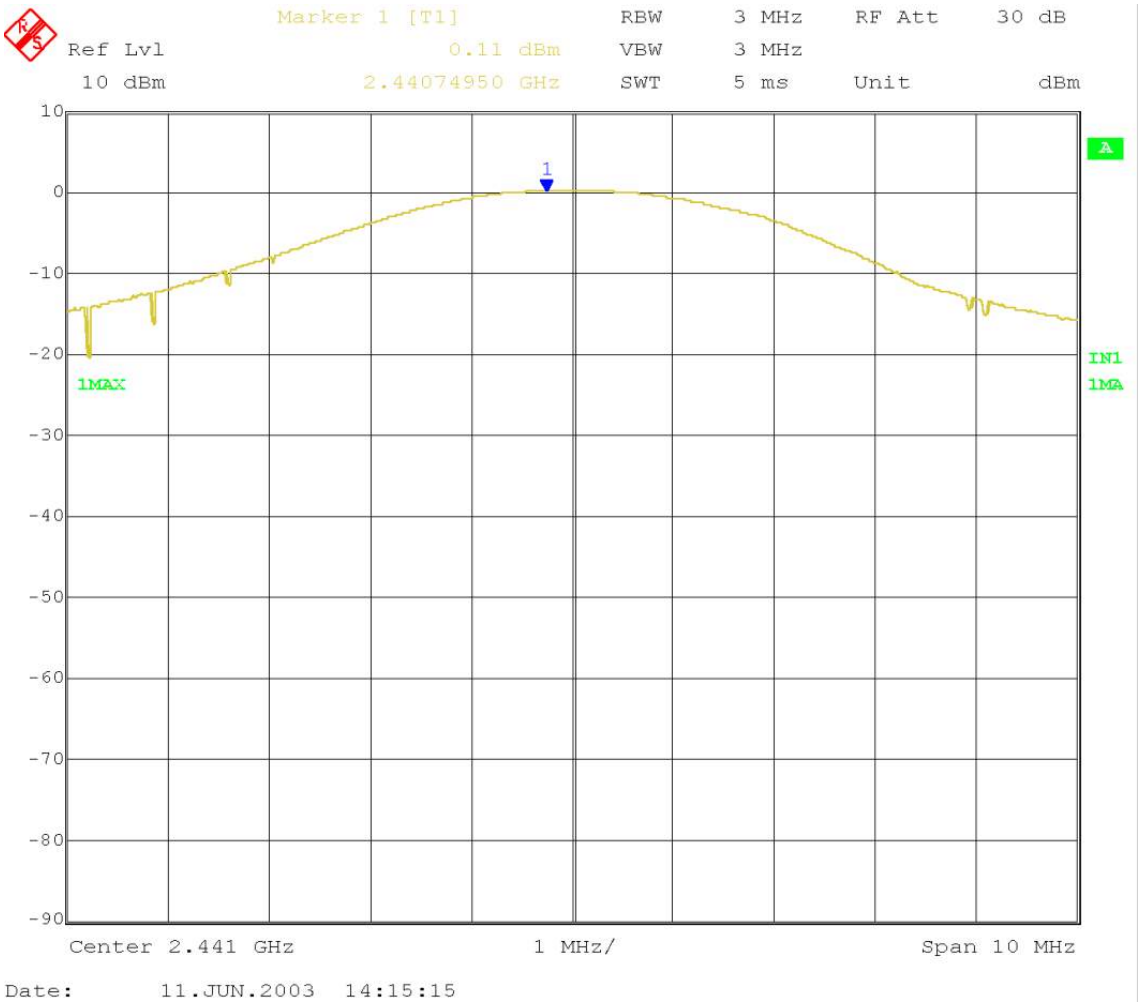
PEAK OUTPUT POWER (CONDUCTED).

Lowest Channel: 2402 MHz.



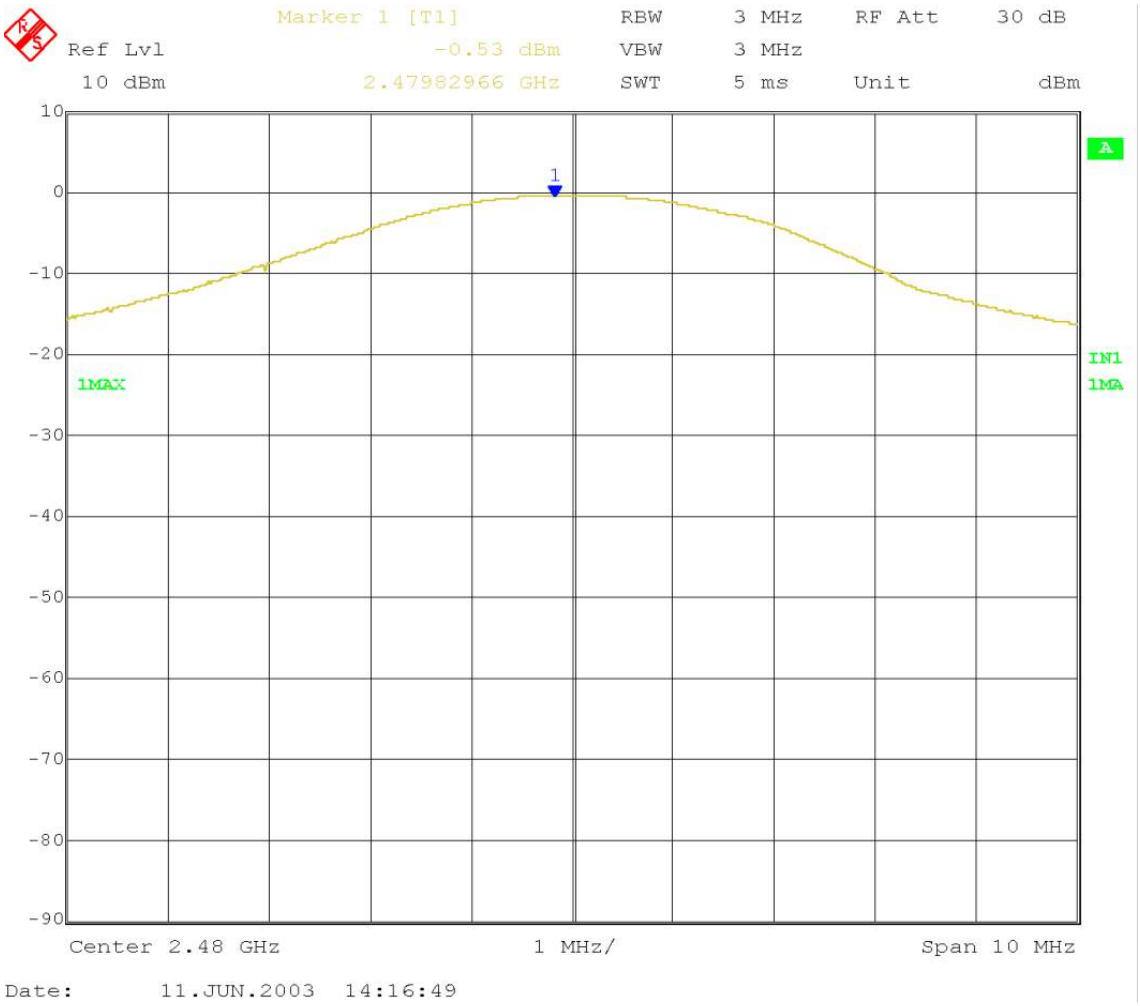
PEAK OUTPUT POWER (CONDUCTED).

Middle Channel: 2441 MHz.



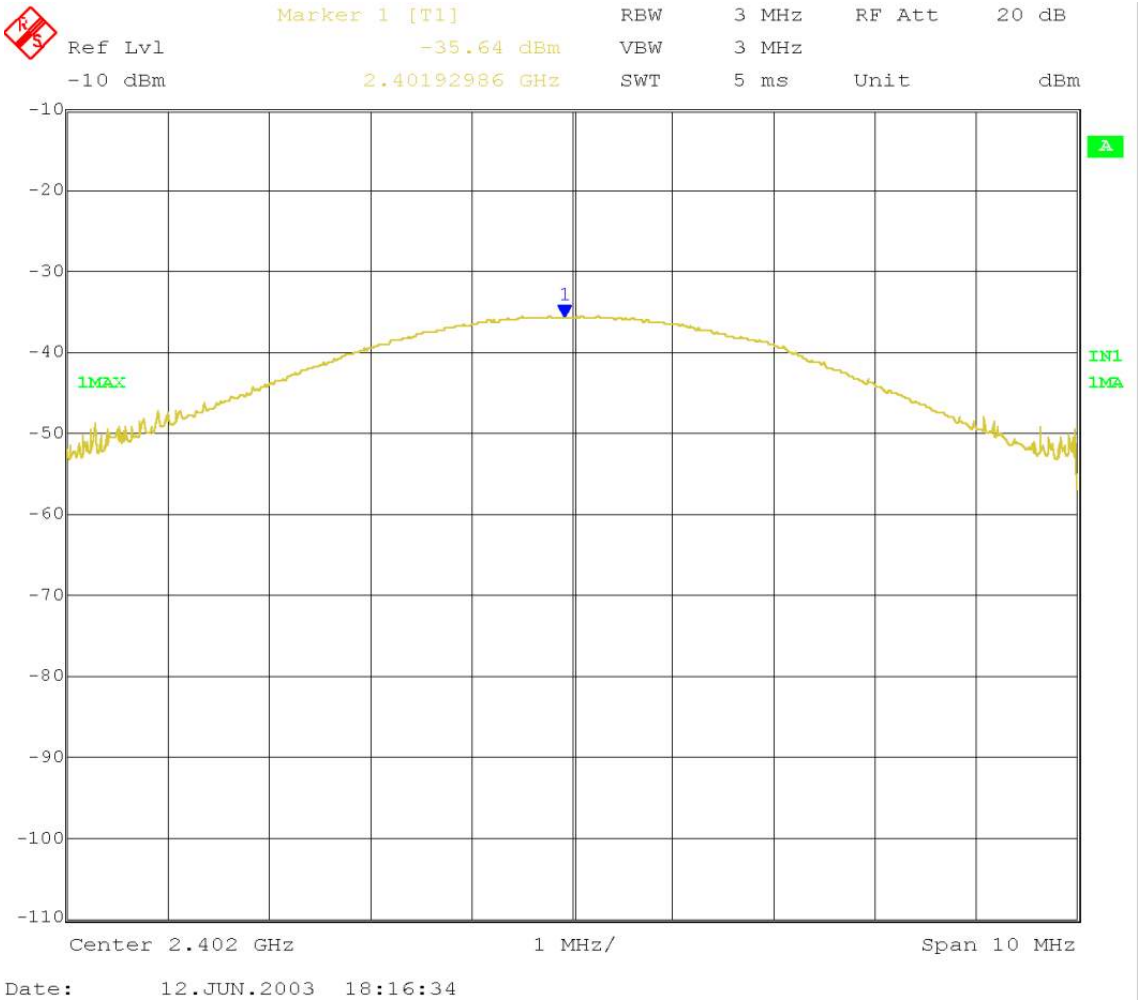
PEAK OUTPUT POWER (CONDUCTED).

Highest Channel: 2480 MHz.



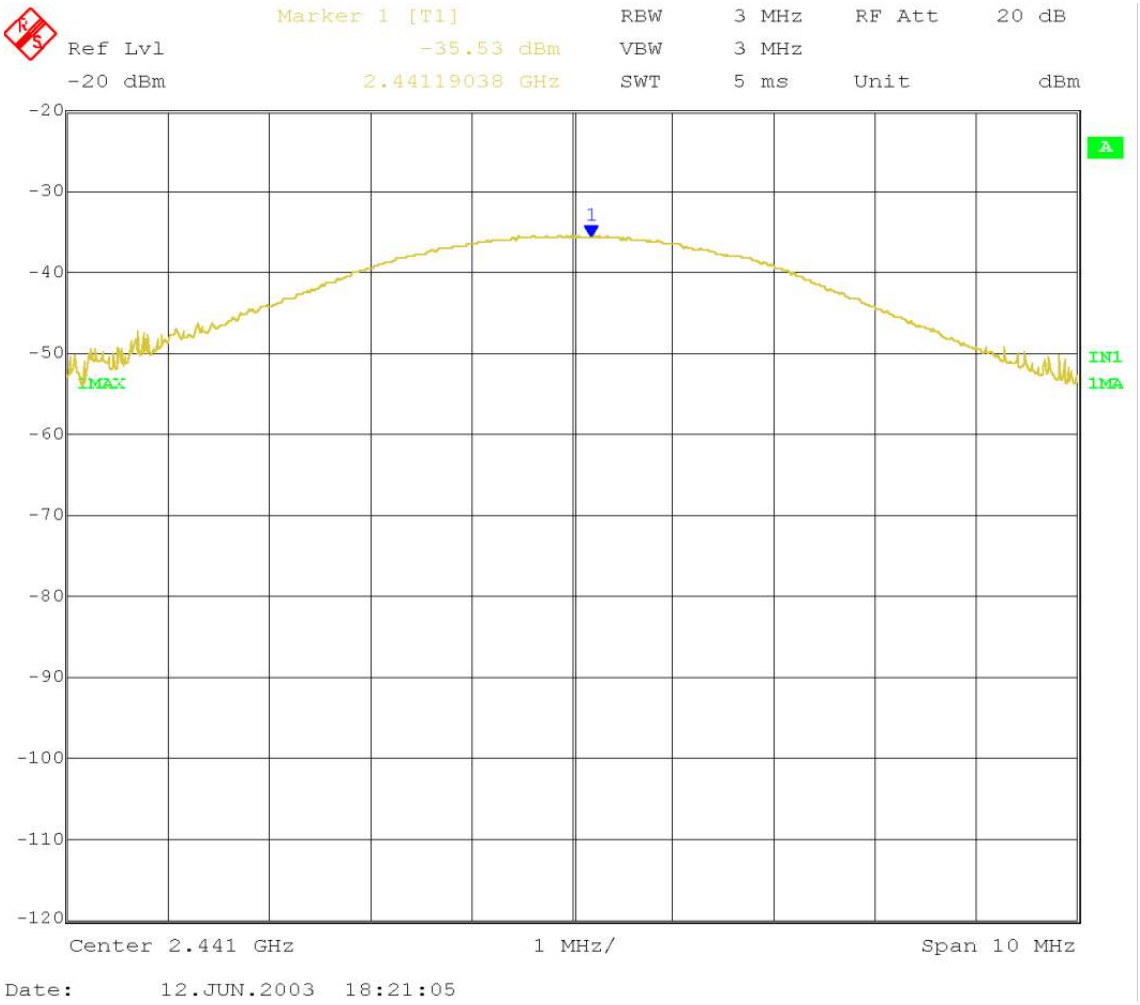
PEAK OUTPUT POWER (RADIATED).

Lowest Channel: 2402 MHz.



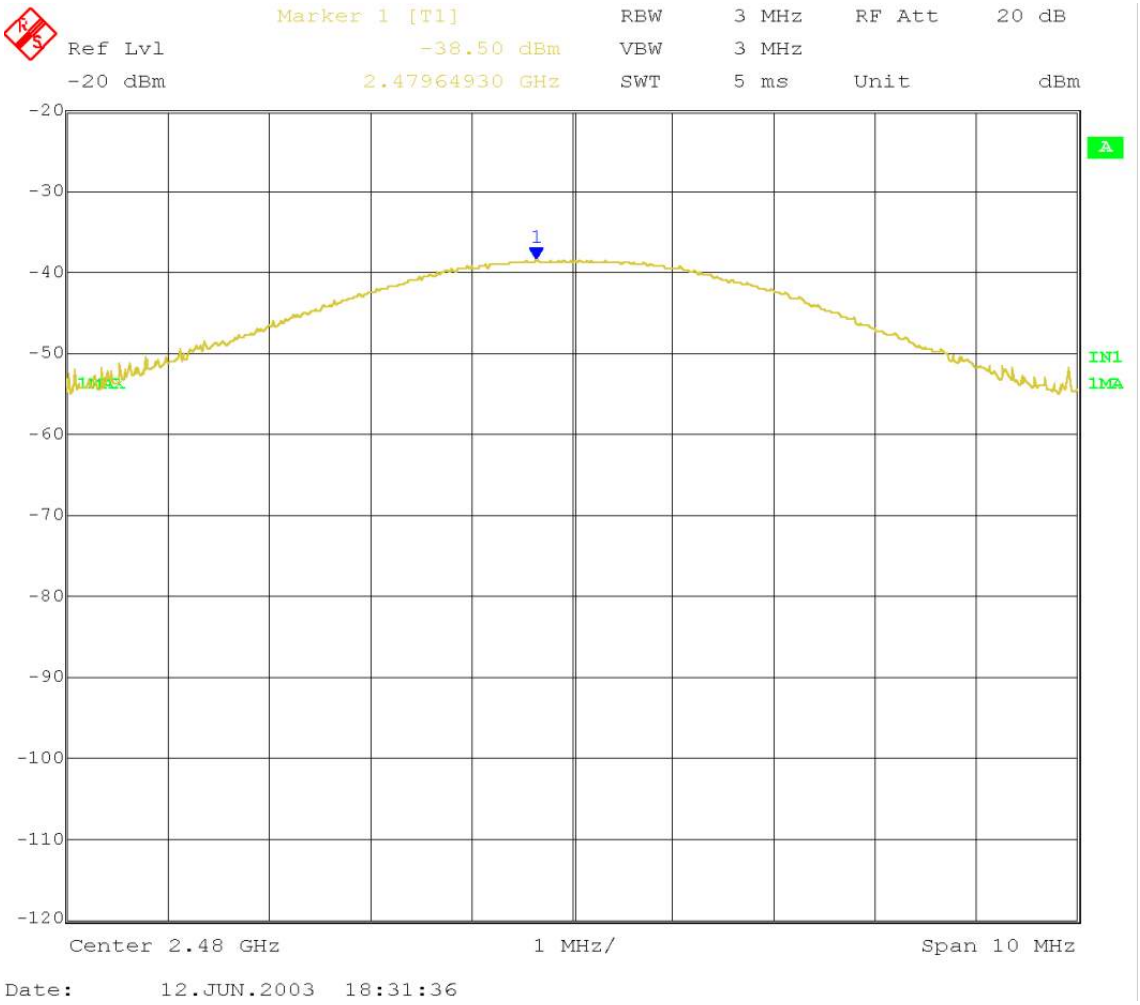
PEAK OUTPUT POWER (RADIATED).

Middle Channel: 2441 MHz.



PEAK OUTPUT POWER (RADIATED).

Highest Channel: 2480 MHz.



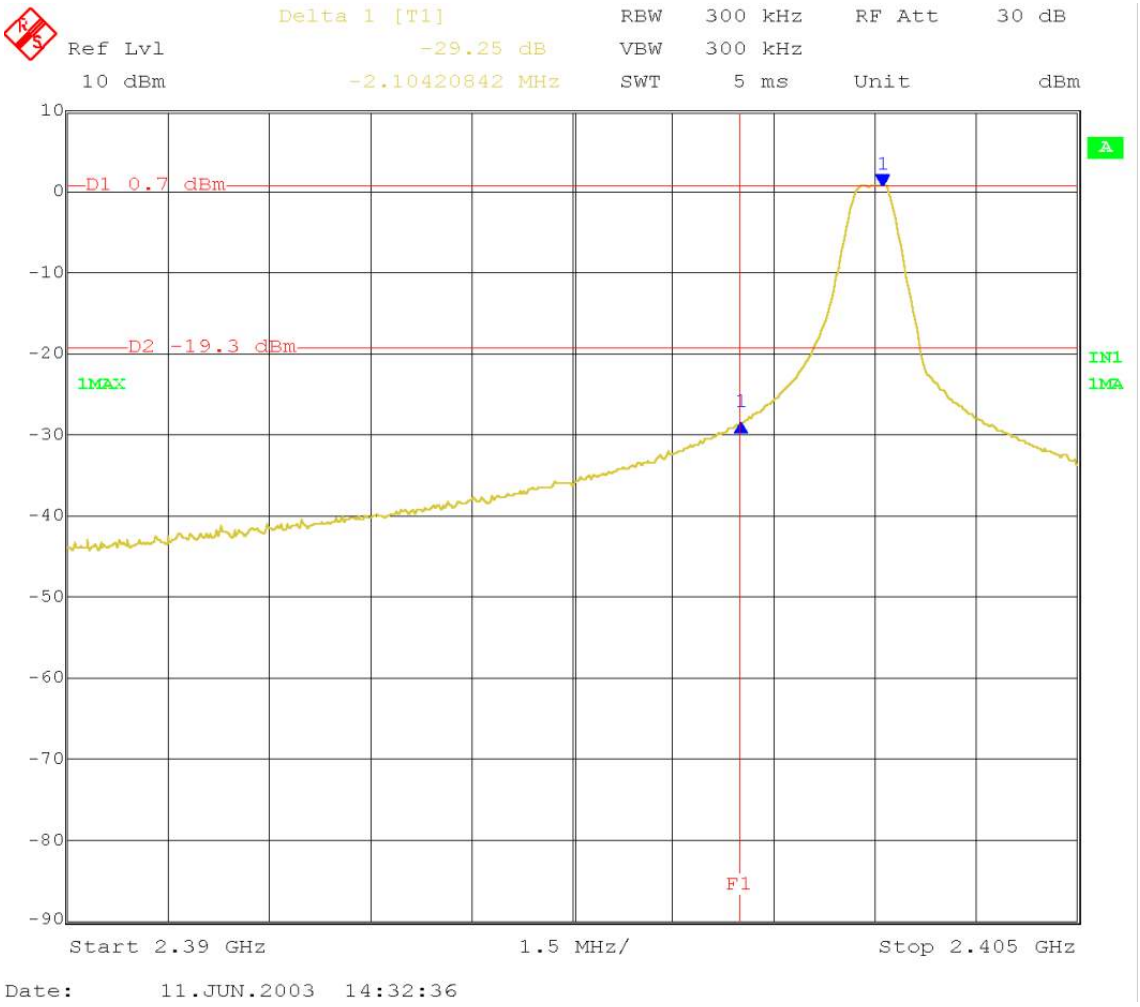
Section 15.247 Subclause (c). Band-edge of conducted emissions (Transmitter)

SPECIFICATION

Emissions outside the frequency band in which the intentional radiator is operating shall be at least 20dB below the highest level of the desired power.

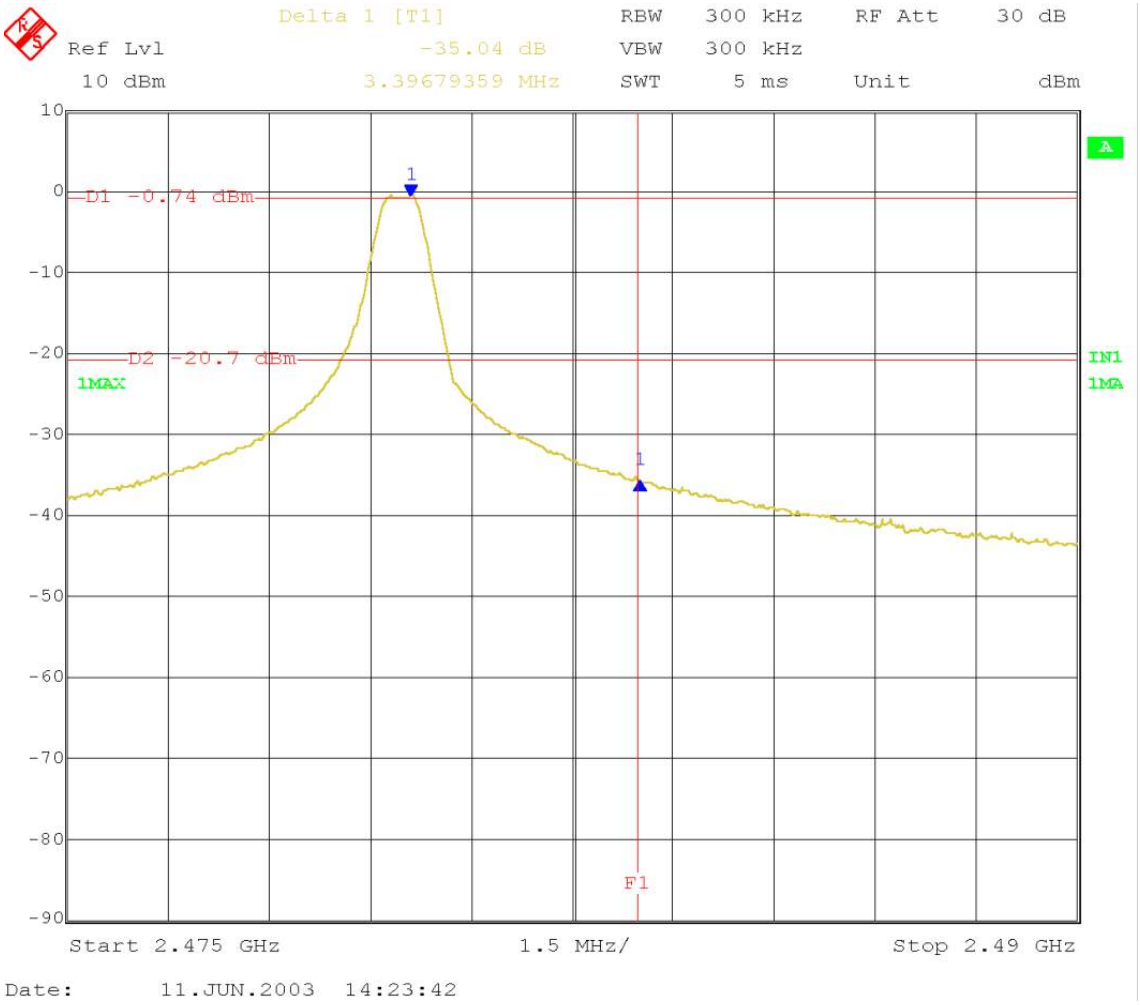
RESULTS:

1. LOW FREQUENCY SECTION 2402 MHz (HOPPING OFF). See next plot.



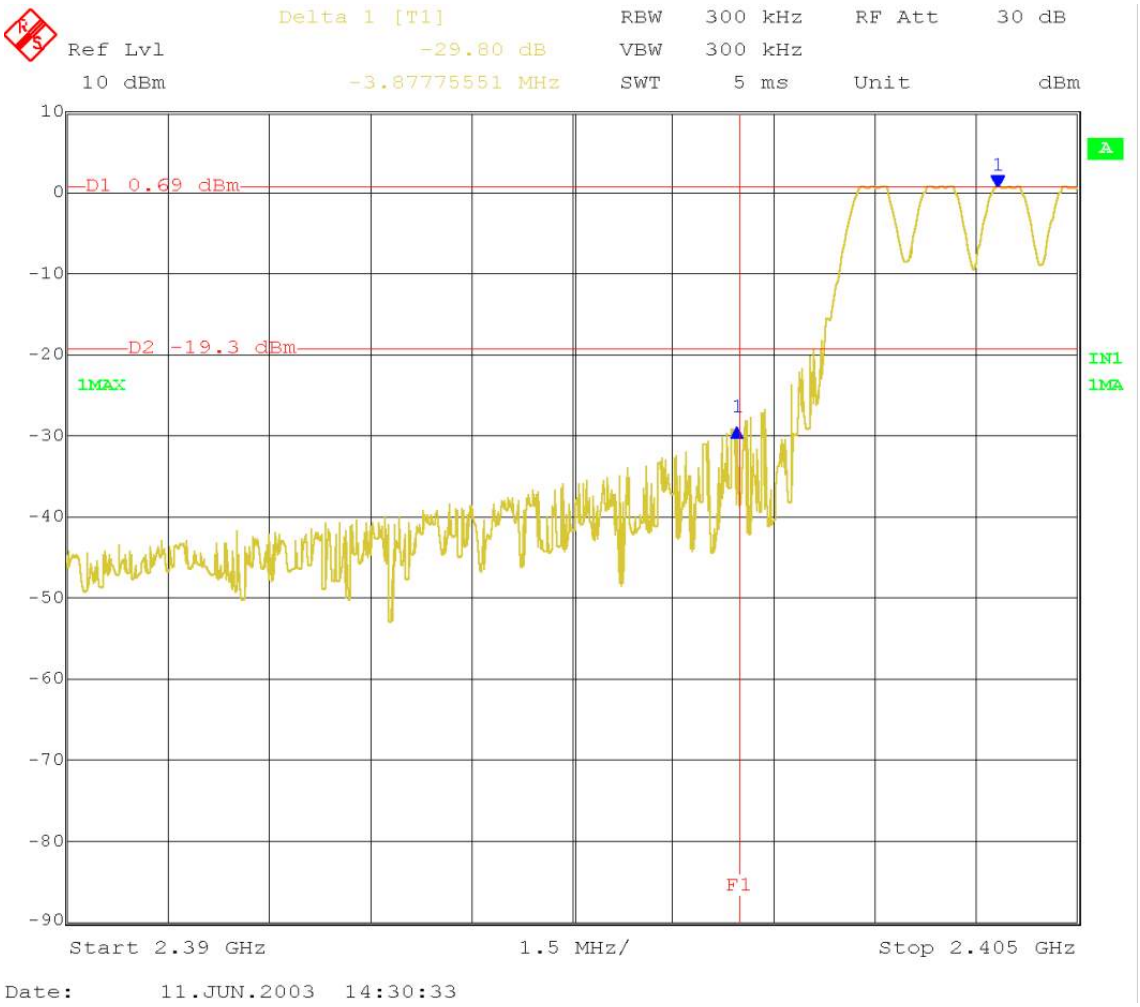
Verdict: PASS

2. HIGH FREQUENCY SECTION 2480 MHz (HOPPING OFF). See next plot.



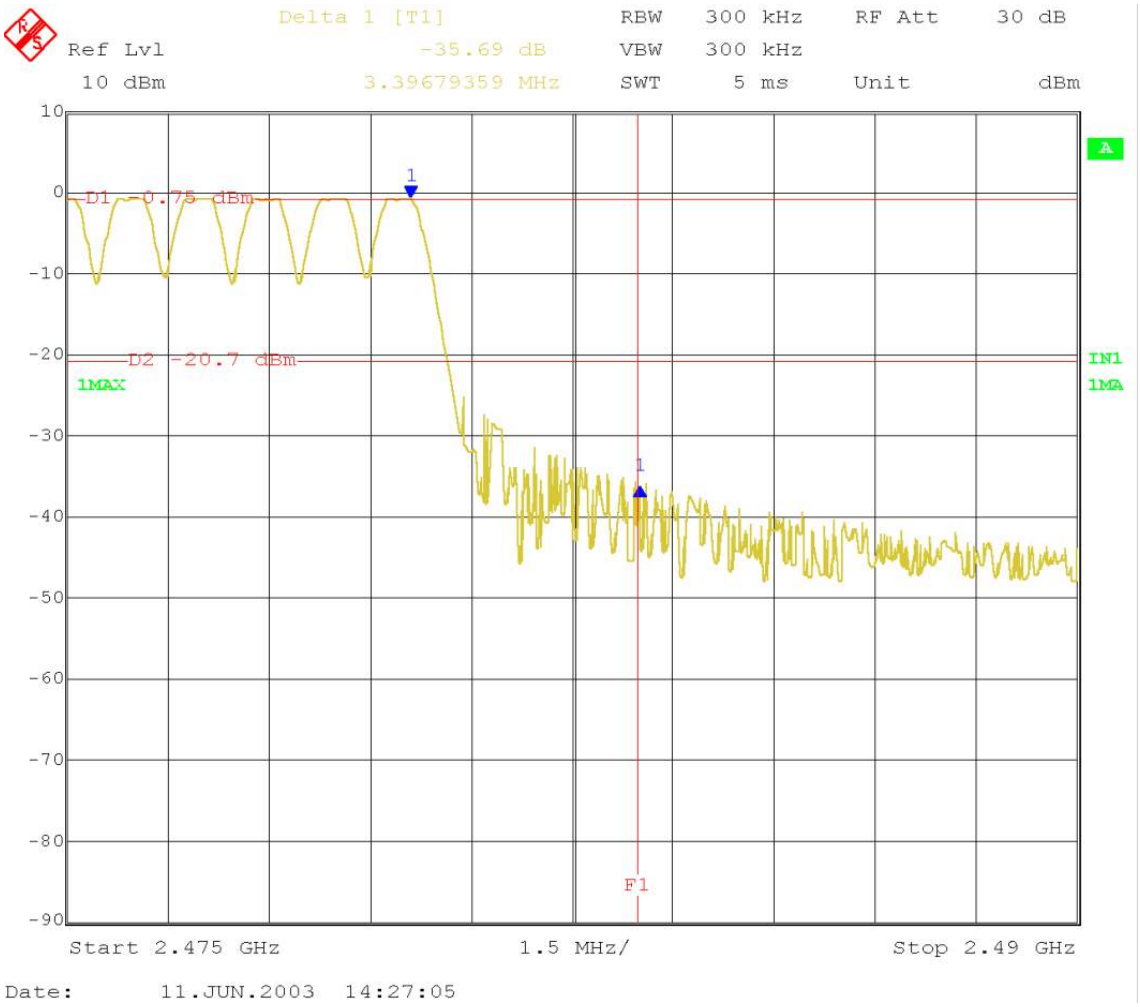
Verdict: PASS

3. LOW FREQUENCY SECTION (HOPPING ON). See next plot.



Verdict: PASS

4. HIGH FREQUENCY SECTION (HOPPING ON). See next plot.



Verdict: PASS

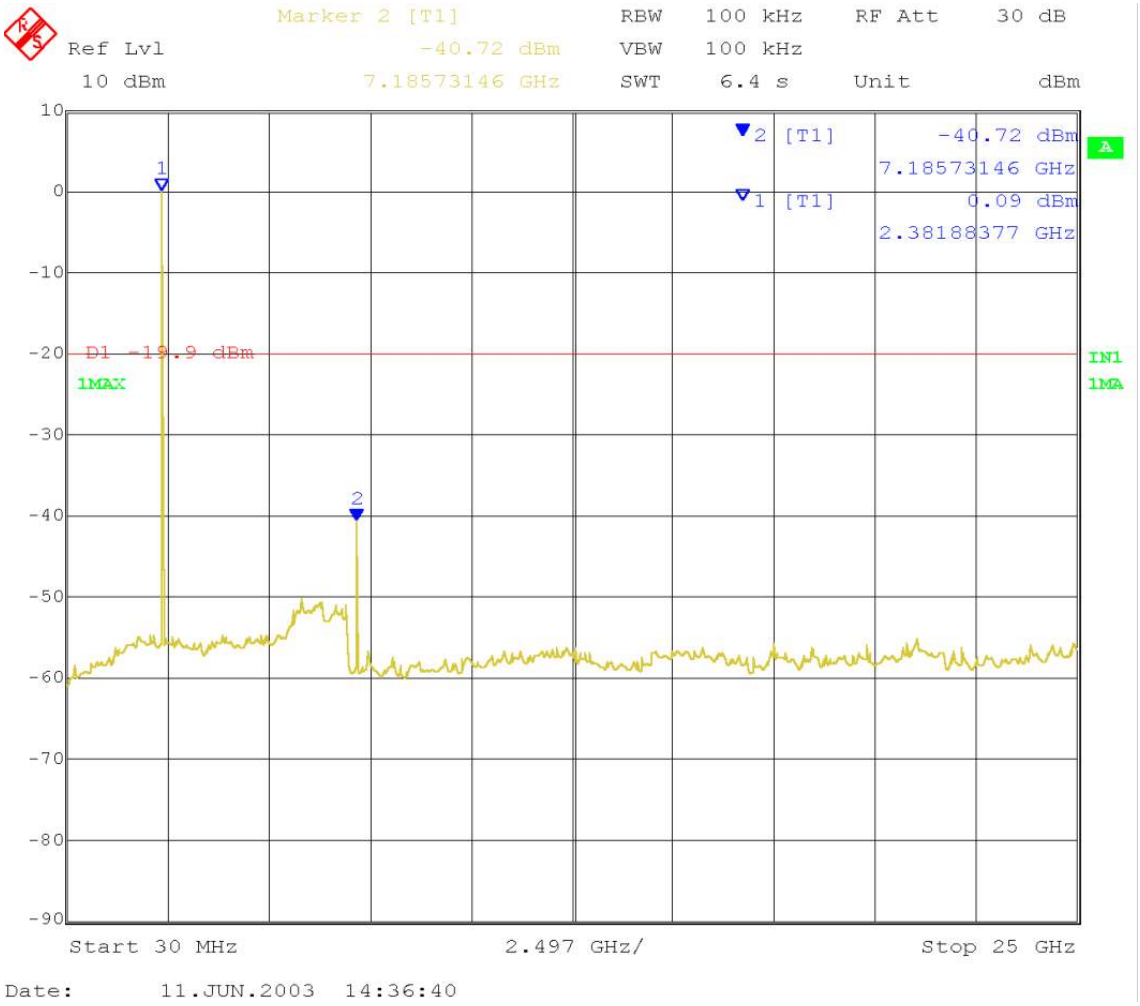
Section 15.247 Subclause (c). Emission limitations conducted (Transmitter)

SPECIFICATION

In any 100 kHz bandwidth outside the frequency band in which the intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power.

RESULTS:

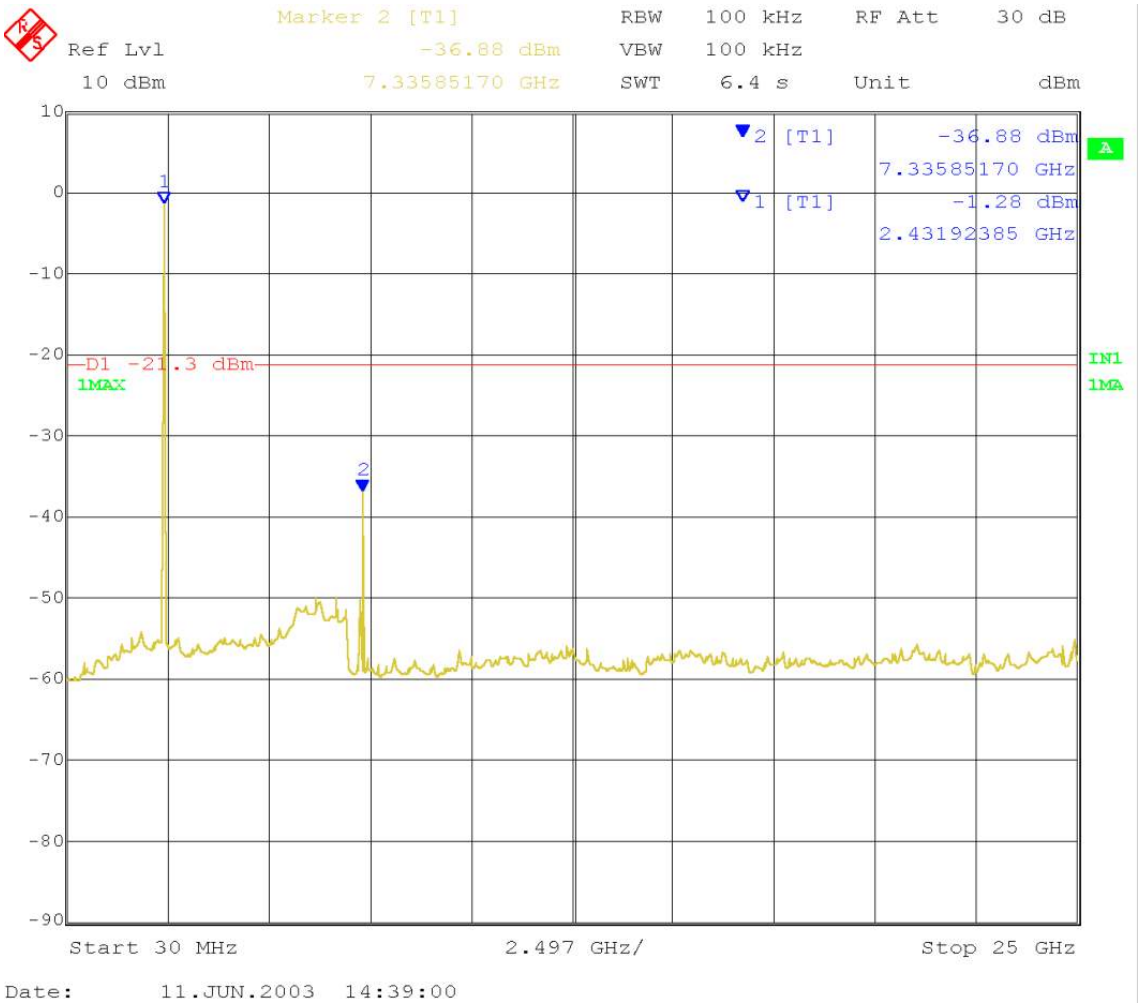
1. LOWEST CHANNEL (2402 MHz): 30 MHz-25 GHz (see next plot).



Note: The peak above the limit is the carrier frequency.

Verdict: PASS

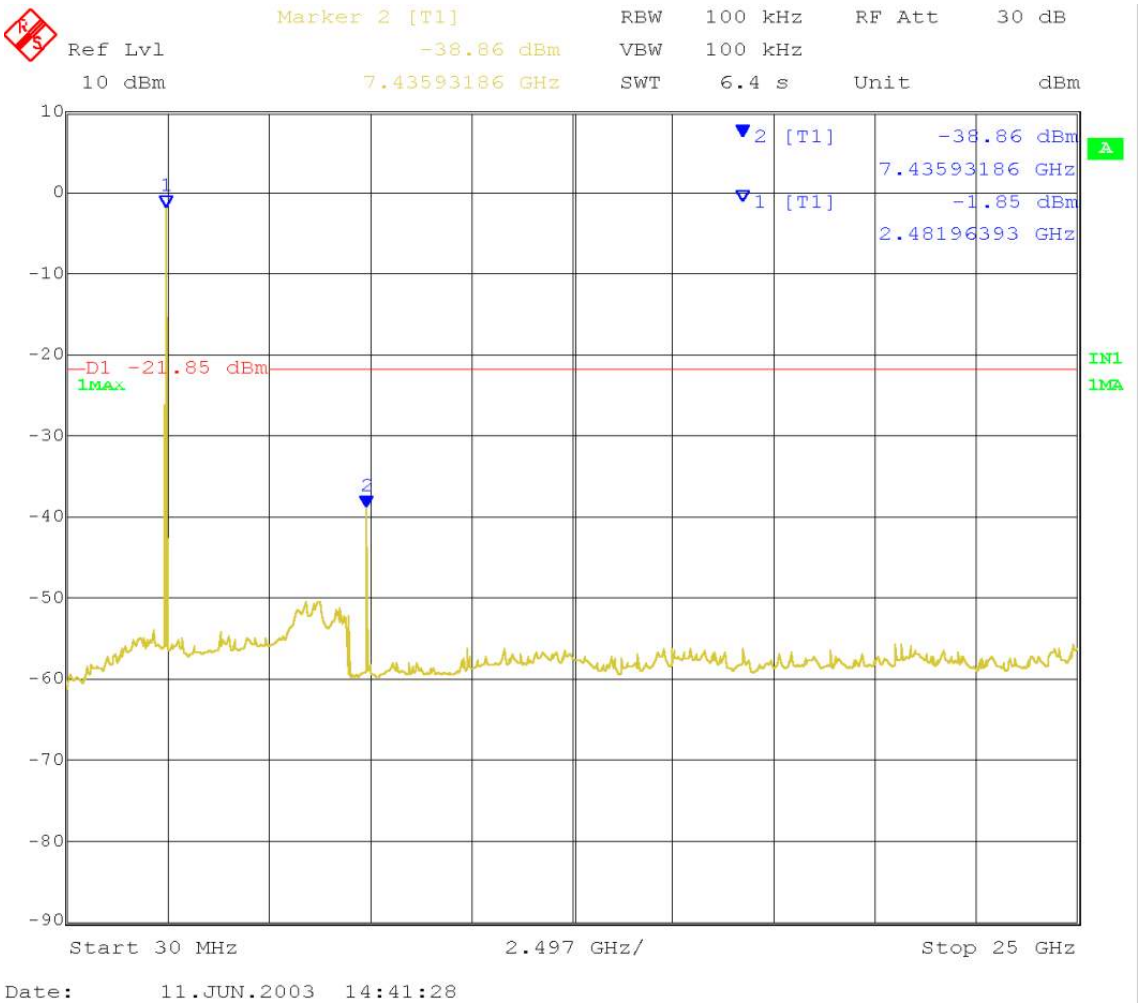
2. MIDDLE CHANNEL (2441 MHz): 30 MHz-25 GHz (see next plot).



Note: The peak above the limit is the carrier frequency.

Verdict: PASS

3. HIGH CHANNEL (2480 MHz): 30 MHz-25 GHz (see next plot).



Note: The peak above the limit is the carrier frequency.

Verdict: PASS

Section 15.247 Subclause (c). Emission limitations radiated (Transmitter)

SPECIFICATION

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) (see §15.205(c)):

Frequency Range (MHz)	Field strength (µV/m)	Field strength (dBµV/m)	Measurement distance (m)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	300
1.705 - 30.0	30	-	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
960 - 25000	500	54	3

The emission limits shown in the above table are based on measurements employing CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

RESULTS:

The field strength is calculated by adding correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

The equipment transmits continuously in the selected channel so it is not necessary a duty cycle correction factor.

1. TRANSMITTER OPERATING IN CHANNEL: LOWEST (2402 MHz).

Frequency range 30 MHz-1000 MHz.

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dBµV/m)	Measurement Uncertainty (dB)
160.1	Vertical	Quasi-peak	12.2	±3.8
166.8	Vertical	Quasi-peak	13.7	±3.8
168.1	Vertical	Quasi-peak	12.2	±3.8
176.1	Vertical	Quasi-peak	13.7	±3.8
177.5	Vertical	Quasi-peak	15.2	±3.8
180.1	Vertical	Quasi-peak	12.0	±3.8
182.9	Vertical	Quasi-peak	10.7	±3.8

Frequency range 1 GHz-25 GHz.

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dBµV/m)	Measurement Uncertainty (dB)
4814.7295	Vertical	Peak	47.98	+2.48 / -2.25
4814.7295	Vertical	Average	31.31	+2.48 / -2.25
7203.2064	Vertical	Peak	50.70	+2.48 / -2.25
7203.2064	Vertical	Average	35.95	+2.48 / -2.25
14412.3246	Vertical	Peak	42.60	+2.48 / -2.25
14412.3246	Vertical	Average	30.69	+2.48 / -2.25

No spurious signals found inside the restricted bands 2310-2390 MHz and 2483.5-2500 MHz

Verdict: PASS.

2. TRANSMITTER OPERATING IN CHANNEL: MIDDLE (2441 MHz).

Frequency range 30 MHz-1000 MHz.

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dBµV/m)	Measurement Uncertainty (dB)
158.8	Vertical	Quasi-peak	13.2	±3.8
160.1	Vertical	Quasi-peak	16.4	±3.8
161.4	Vertical	Quasi-peak	14.6	±3.8
165.4	Vertical	Quasi-peak	14.0	±3.8
166.8	Vertical	Quasi-peak	19.1	±3.8
168.1	Vertical	Quasi-peak	17.6	±3.8
169.4	Vertical	Quasi-peak	12.8	±3.8
335.9	Vertical	Quasi-peak	19.0	±3.8
360.0	Vertical	Quasi-peak	20.6	±3.8
364.0	Vertical	Quasi-peak	20.8	±3.8
376.0	Vertical	Quasi-peak	18.4	±3.8
388.1	Vertical	Quasi-peak	19.2	±3.8

Frequency range 1 GHz-25 GHz.

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dBµV/m)	Measurement Uncertainty (dB)
4893.6874	Vertical	Peak	44.89	+2.48 / -2.25
4893.6874	Vertical	Average	32.08	+2.48 / -2.25
7321.6433	Vertical	Peak	49.22	+2.48 / -2.25
7321.6433	Vertical	Average	36.39	+2.48 / -2.25
14643.7876	Vertical	Peak	42.12	+2.48 / -2.25
14643.7876	Vertical	Average	30.06	+2.48 / -2.25

No spurious signals found inside the restricted bands 2310-2390 MHz and 2483.5-2500 MHz

Verdict: PASS.

3. TRANSMITTER OPERATING IN CHANNEL: HIGHEST (2480 MHz).

Frequency range 30 MHz-1000 MHz.

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dBµV/m)	Measurement Uncertainty (dB)
157.5	Vertical	Quasi-peak	11.6	±3.8
160.1	Vertical	Quasi-peak	15.0	±3.8
161.4	Vertical	Quasi-peak	13.0	±3.8
165.4	Vertical	Quasi-peak	12.9	±3.8
166.8	Vertical	Quasi-peak	17.9	±3.8
168.1	Vertical	Quasi-peak	18.0	±3.8
169.5	Vertical	Quasi-peak	14.7	±3.8
170.8	Vertical	Quasi-peak	15.1	±3.8
172.2	Vertical	Quasi-peak	16.0	±3.8
174.8	Vertical	Quasi-peak	12.6	±3.8
177.5	Vertical	Quasi-peak	12.2	±3.8
182.9	Vertical	Quasi-peak	10.2	±3.8

Frequency range 1 GHz-25 GHz.

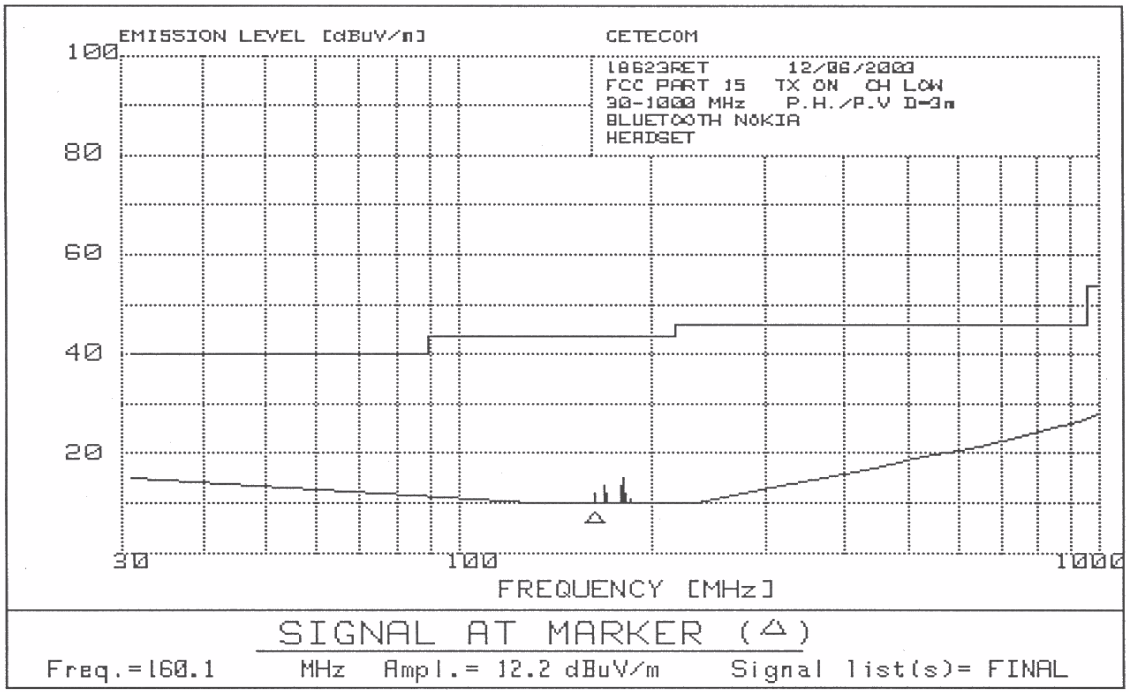
Spurious frequency (MHz)	Polarization	Detector	Emission Level (dBµV/m)	Measurement Uncertainty (dB)
4952.9058	Vertical	Peak	46.17	+2.48 / -2.25
4952.9058	Vertical	Average	32.89	+2.48 / -2.25
7440.0802	Vertical	Peak	56.20	+2.48 / -2.25
7440.0802	Vertical	Average	40.90	+2.48 / -2.25
14875.2505	Vertical	Peak	44.20	+2.48 / -2.25
14875.2505	Vertical	Average	32.54	+2.48 / -2.25

No spurious signals found inside the restricted bands 2310-2390 MHz and 2483.5-2500 MHz

Verdict: PASS.

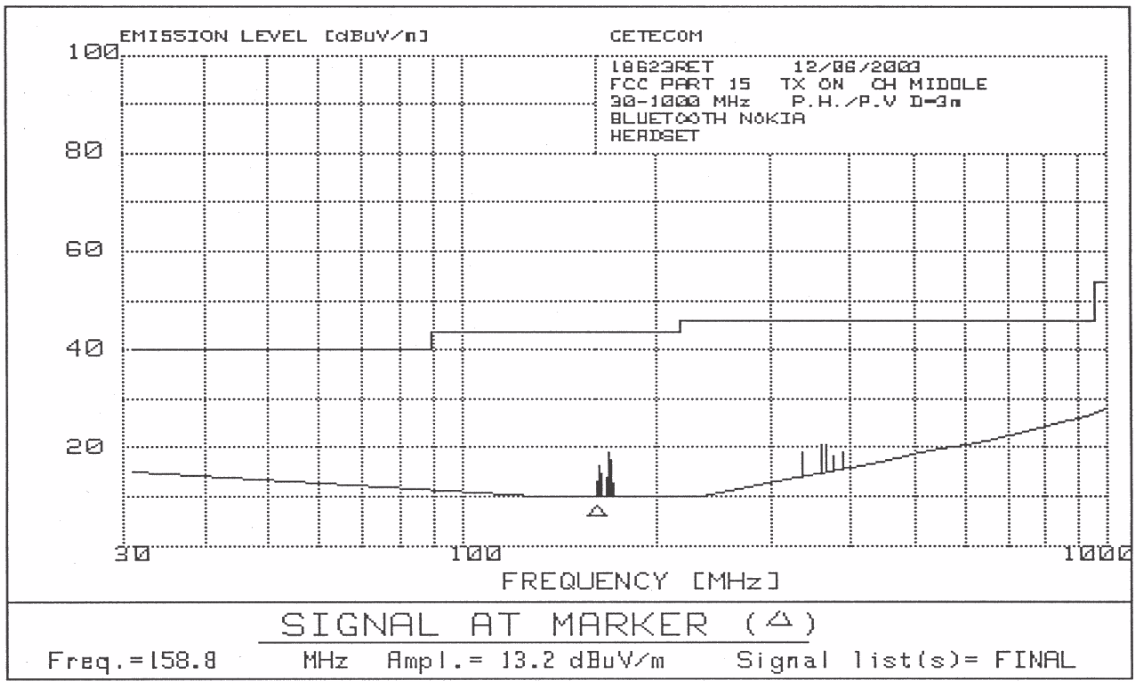
FREQUENCY RANGE 30 MHz-1000 MHz.

CHANNEL: Lowest (2402 MHz).



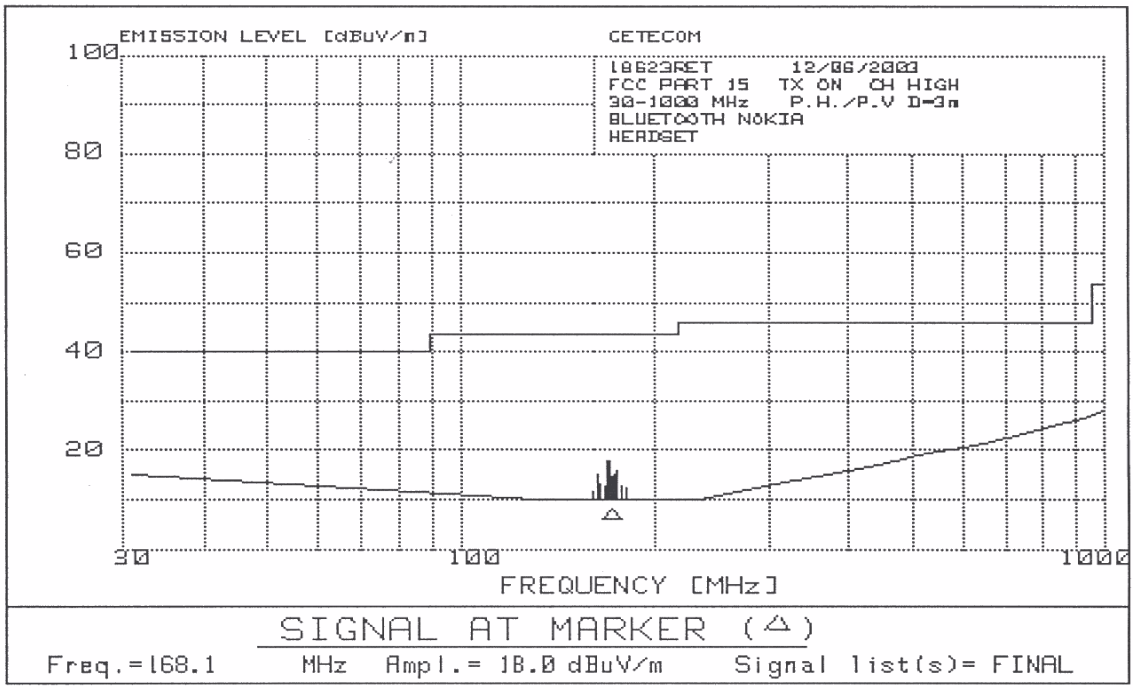
Resolution bandwidth = 100 kHz.
Video bandwidith = 100 kHz.

CHANNEL: Middle (2441 MHz).



Resolution bandwidth = 100 kHz.
Video bandwidith = 100 kHz.

CHANNEL: Highest (2480 MHz).



Resolution bandwidth = 100 kHz.
Video bandwidith = 100 kHz.