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TEST REPORT

Report No.: 22345RET

TEST NAME: FCC PART 22, PART 24 & PART 15 (Electromagnetic emissions)

Product : QUAD-BAND GSM/GPRS MODULE
Trade Mark : TELIT
Model/type Ref. : GE864-QUAD
GE864-PY
Manufacturer : TELIT COMMUNICATIONS S.p.A
Requested by : TELIT COMMUNICATIONS S.p.A
Other identification of the product : FCC ID: RI7GE864
IC: 5131A-GM864
Standard(s) : FCC Part 22 & 24
FCC Part 15, Subpart B y C

This test report includes 4 annexes and therefore the total number of pages is 87

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Date: 2005-11-29	Test operator	Revised by:	Approved by:
	M. Pérez/R. López	W. Lamas	A. Rojas
	CENTRO DE TECNOLOGÍA DE LAS COMUNICACIONES, S.A.		
	Technical Director		

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1. COMPETENCE AND GUARANTEES

Centro de Tecnología de las Comunicaciones (CETECOM), S.A. is a laboratory with a measurement facility in compliance with the requirements of Section 2.948 of the FCC rules and has been added to the list of facilities whose measurements data will be accepted in conjunction with applications for Certification under Parts 15 or 18 of the Commission's Rules. Registration Number: 905266.

Centro de Tecnología de las Comunicaciones (CETECOM), S.A. is a laboratory with a measurement site in compliance with the requirements of RSS 212, Issue 1 (Provisional) and has been added to the list of filed sites of the Canadian Certification and Engineering Bureau. Reference File Number: IC 4621.

In order to assure the traceability to other national and international laboratories, CETECOM has a calibration and maintenance programme for its measuring equipment.

CETECOM guarantees the reliability of the data presented in this report, which is the result of measurements and tests performed to the item under test on the date and under the conditions stated on the report and is based on the knowledge and technical facilities available at CETECOM at the time of execution of the test.

CETECOM is liable to the client for the maintenance by its personnel of the confidentiality of all information related to the item under test and the results of the test.

2. GENERAL CONDITIONS

1. This report only refers to the item that has undergone the test.
2. This report does not constitute or imply by its own an approval of the product by the Certification Bodies or competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without written approval of CETECOM.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written approval of CETECOM and the Accreditation Bodies.

3. CHARACTERISTICS OF THE TEST

3.1 TEST REQUESTED

1. Measurements for PCS 850 and PCS 1900 device according to FCC parts 22 and 24
2. Continuous conducted emission, power leads:

Standard: FCC Rules and Regulations 47 CFR Part 15

Limit: Class B

Method: FCC Rules and Regulations 47 CFR Part 15, Subpart B y C

3. Radiated emission, electromagnetic field:

Standard: FCC Rules and Regulations 47 CFR Part 15

Limit: Class B

Method: FCC Rules and Regulations 47 CFR Part 15, Subpart B

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3.2 REQUIREMENTS AND METHOD

The test has been carried out according to the following documents and standards:

1. FCC part 22.
2. FCC part 24.
3. FCC Rules and Regulations 47 CFR Part 15, Subpart B: Limits and methods of measurements for radio frequency devices. Unintentional radiators.
4. FCC Rules and Regulations 47 CFR Part 15, Subpart C: Limits and methods of measurements for radio frequency devices. Intentional radiators.

Radiated testing was performed in Cetecom's semi-anechoic chamber. This site has been fully described in a report submitted to the FCC and was accepted in a letter dated July 25, 2002. Radiated measurements were made in accordance with the general procedures of ANSI C63.4 and substitution method according to TIA/EIA 603.

The testing procedures used are:

1. PEEM001: Medida de la tensión perturbadora en bornes de alimentación según EN 55022.
2. PEEM002: Medida del campo perturbador radiado según EN 55022.

Uncertainty (factor $k=2$) was calculated according to the following CETECOM's internal documents:

1. PODT000: Procedimiento para el cálculo de incertidumbres de medida
2. FEM12_07: Formato de cálculo de incertidumbre a aplicar en la medida de la tensión perturbadora en bornes de alimentación según EN 55022.
3. FEM13_08: Formato de cálculo de incertidumbre a aplicar en la medida del campo perturbador radiado según EN 55022.
4. FET298_01: Formato de cálculo de incertidumbre a aplicar en la medida del campo perturbador radiado entre 1 y 25 GHz.

The instrumentation used to perform the testing is listed below:

1. Semianechoic Absorber Lined Chamber IR 11. BS.
2. Control Chamber IR 12.BC.
3. Spectrum Analyzer R&S FSM.
4. Bilog antenna CHASE CBL6111.
5. Antenna tripod EMCO 11968C.
6. Antenna mast EM 1072 NMT.
7. Rotating table EM 1084-4. ON.
8. Double-ridge Guide Horn antenna 1-18 GHz HP 11966E.
9. Double-ridge Guide Horn antenna 18-40 GHz Agilent 119665J.
10. RF pre-amplifier Miteq AFS5-04001300-15-10P-6.
11. RF pre-amplifier Miteq JS4-12002600-30-5A.

12. EMI Test Receiver R&S ESIB26.
13. Universal Radio communication Tester R&S CMU200.
14. Power splitter Picosecond 5333.
15. 10 dB attenuator HP 8491B.
16. Multi Device Controller EMCO 2090.
17. Climatic chamber HERAEUS VM 07/100.
18. DC Power supply R & S NGPE 40/40.
19. Transient limiter. HP 11947A
20. Line Impedance Stabilization Network (L.I.S.N.) R&S. ESH2-Z5

4. IDENTIFICATION DATA SUPPLIED BY THE APPLICANT

Identification data in this section has been supplied by the client.

4.1 APPLICANT

Name or Company: TELIT Communications S.p.A.

V.A.T.: 03711600266

Address: Via Stazione di Prosecco 5/b

City: Trieste

Postal code: 34010

Country: ITALY

Telephone: +39 040 4192111

Fax: +39 040 4192 383

4.2 REPRESENTATIVE

Name: Andrea Fragiacomio

4.3 TEST SAMPLES SUPPLIER

Name or Company: Same as indicated in point 4.1.

Samples undergoing test have been selected by: **the client.**

4.4 IDENTIFICATION OF ITEM/ITEMS TESTED

Product QUAD-BAND GSM/GPRS MODULE

Trade mark: TELIT

Model: GE864-QUAD, GE864-PY

Hw version: 1

SW version: PS: 05.03.00 / AL: 07.01.002-B001-GE864-QUAD

Other identification of the product: FCC ID: RI7GE864

IC: 5131A-GM864

Manufacturer: TELIT Communications S.p.A.

Country of manufacture: ITALY

Manufacture site: Via Stazione di Prosecco 5/b, Trieste, ITALY

Description: GPRS class 10 modem, 850/900/1800/1900MHz, without connector and SIM holder.

5. USAGE OF SAMPLES, PERIOD OF TESTING AND ENVIRONMENTAL CONDITIONS

5.1 USAGE OF SAMPLES

Sample M/01 is formed by the following elements:

<u>Control No.</u>	<u>Description</u>	<u>Model</u>	<u>Serial No.</u>	<u>Date of reception</u>
22345/04	Evaluation Board	---	---	28/06/05
22345/05	Quad band GSM module with antenna connector	GE864-QUAD GE864-PY	357022009999056	12/09/05
---	Antenna with sma connector	---	---	---

Sample M/02 is formed by the following elements:

<u>Control No.</u>	<u>Description</u>	<u>Model</u>	<u>Serial No.</u>	<u>Date of reception</u>
22345/04	Evaluation Board	---	---	28/06/05
22345/05	Quad band GSM/GPRS module with antenna connector	GE864-QUAD GE864-PY	357022009999056	12/09/05

Sample S/01 is composed of the following elements:

<u>Control No.</u>	<u>Description</u>	<u>Model</u>	<u>Serial No.</u>	<u>Date of reception</u>
22345/02	Quad band GSM/GPRS module with antenna connector	GE864-QUAD GE864-PY	357022009999023	11/06/05
22345/04	Evaluation board	---	---	28/06/05

The sample **S/02** is the same that the S/01 but with a AC/DC adapter, trade mark: FullWat, model: MWS28.

During the tests were used next ancillary equipments:

<u>Internal Control</u> <u>Nr.</u>	<u>Description</u>	<u>Model</u>	<u>Serial</u> <u>number</u>	<u>Date of arrival</u>
---	Antenna with sma connector	---	---	---
---	RS 232 wire, property of CETECOM	---	---	---

1. Sample M/01 has undergone the following test(s).
Radiated output power and Radiated emissions measurements indicated in annex A and B.
2. Sample M/02 has undergone the following test(s).
Conducted output power, Occupied bandwidth, Frequency stability and Spurious emissions at antenna terminal tests indicated in annex A and B.
3. Sample S/01 has undergone the following test(s):
Radiated emission, electromagnetic field.
4. Sample S/02 has undergone the following test(s):
Continuous conducted emission, power leads.

5.2 PERIOD OF TESTING

The performed test started on 2005-08-31 and finished on 2005-10-21.

The tests as detailed in this report have been performed at CETECOM.

5.3 ENVIROMENTAL CONDITIONS

In the control chamber the following limits were not exceeded during the test:

Temperature	Min. = 26 °C Max. = 26 °C
Relative humidity	Min. = 48 % Max. = 48 %
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 0,5 Ω

In the semianechoic chamber (21 meters x 11 meters x 8 meters) the following limits were not exceeded during the test.

Temperature	Min. = 24 °C Max. = 24 °C
Relative humidity	Min. = 52 % Max. = 52 %
Air pressure	Min. = 1021 mbar Max. = 1021 mbar
Shielding effectiveness	> 100 dB
Electric insulation	> 10 k Ω
Reference resistance to earth	< 0,5 Ω
Normal site attenuation (NSA)	< ± 4 dB at 10 m distance between item under test and receiver antenna, (30 MHz to 1000 MHz)
Field homogeneity	More than 75% of illuminated surface is between 0 and 6 dB (26 MHz to 1000 MHz).

In the chamber for conducted measurements the following limits were not exceeded during the test:

Temperature	Min. = 24 °C Max. = 24 °C
Relative humidity	Min. = 46 % Max. = 46 %
Air pressure	Min. = 1019 mbar Max. = 1019 mbar
Shielding effectiveness	> 100 dB
Electric insulation	> 10 k Ω
Reference resistance to earth	< 0,5 Ω

6. TEST RESULTS

Abbreviations used in the VERDICT column of the following tables are:

P	Pass
F	Fail
NA	not applicable
NM	not measured

FCC PART 22 PARAGRAPH	VERDICT			
	NA	P	F	NM
Clause 22.913: RF output power		P		
Clause 22.355: Frequency stability		P		
Clause 22.917: Spurious emissions at antenna terminals		P		
Clause 22.917: Radiated emissions		P		

FCC PART 24 PARAGRAPH	VERDICT			
	NA	P	F	NM
Clause 24.232: RF output power		P		
Clause 24.235: Frequency stability		P		
Clause 24.238: Spurious emissions at antenna terminals		P		
Clause 24.238: Radiated emissions		P		

MEASURING RESULTS FOR ELECTROMAGNETIC EMISSION	VERDICT			
	NA	P	F	NM
Continuous conducted emission, power leads. Class B. (On the sample S/02)		P		
Radiated emission, electromagnetic field . Class B. (On the sample S/01)		P		

7. REMARKS AND COMMENTS

None.

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8. SUMMARY

Based on the results of the performed test, stated in annex A the item under test is **IN COMPLIANCE** with the specifications listed in section 3.1 "TEST REQUESTED".

NOTE: The results presented in this Test Report apply only to the particular item under test declared in section 4.4 "IDENTIFICATION OF ITEM/ITEMS TESTED" of this document, as presented for test on the date(s) declared in section 5, "USAGE OF SAMPLES, PERIOD OF TESTING AND ENVIRONMENTAL CONDITIONS".

ANNEX A

TEST RESULTS FOR FCC PART 22

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Annex A

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TEST CONDITIONS

Power supply (V):

$$V_{\text{nom}} = 3.80 \text{ Vdc}$$

$$V_{\text{max}} = 4.20 \text{ Vdc}$$

$$V_{\text{min}} = 3.40 \text{ Vdc}$$

The subscripts nom, min and max indicates voltage test conditions (nominal, minimum and maximum respectively, as declared by the applicant).

Type of power supply = DC Voltage from external power supply

Type of antenna = external connectable antenna with sma type connector

TEST FREQUENCIES:

Lowest channel (128): 824.2 MHz

Middle channel (190): 836.6 MHz

Highest channel (251): 848.8 MHz

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RF Output Power (conducted and E.R.P.)SPECIFICATION

§2.1046 and 22.913

METHOD

The conducted RF output power measurements were made at the RF output terminals of the EUT using an attenuator, power splitter and spectrum analyser. The EUT was controlled via the Universal Radio Communication tester R&S CMU200 selecting maximum transmission power of the EUT and GMSK modulated signal.

For radiated measurements the EUT was placed on a 1 m high non-conductive stand inside an anechoic chamber. The measuring antenna was placed at 3 m distance and the maximum field strength was measured for the three channels. The EUT was controlled via the Universal Radio Communication tester R&S CMU200 selecting maximum transmission power of the EUT and GMSK modulated signal.

The Effective Radiated Power (E.R.P.) is obtained by using the Substitution Method according to ANSI/TIA/EIA-603-A.

RESULTS

MAXIMUM OUTPUT POWER (CONDUCTED). See plots in next pages.

Channel	Lowest	Middle	Highest
Maximum peak power (dBm)	32.47	32.92	33.13
Maximum peak power (W)	1.77	1.96	2.06
Measurement uncertainty (dB)	±1.5		

MAXIMUM EFFECTIVE RADIATED POWER E.R.P. (RADIATED).

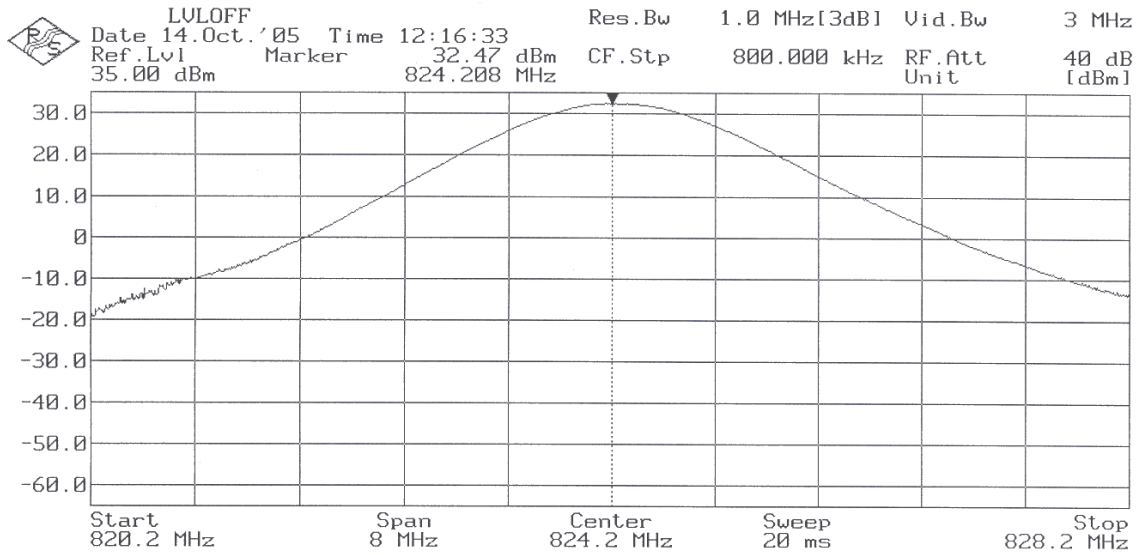
Channel	Lowest	Middle	Highest
Maximum peak power (dBm)	32.28	31.84	31.95
Maximum peak power (W)	1.70	1.53	1.57
Measurement uncertainty (dB)	± 3.8		

Verdict: PASS

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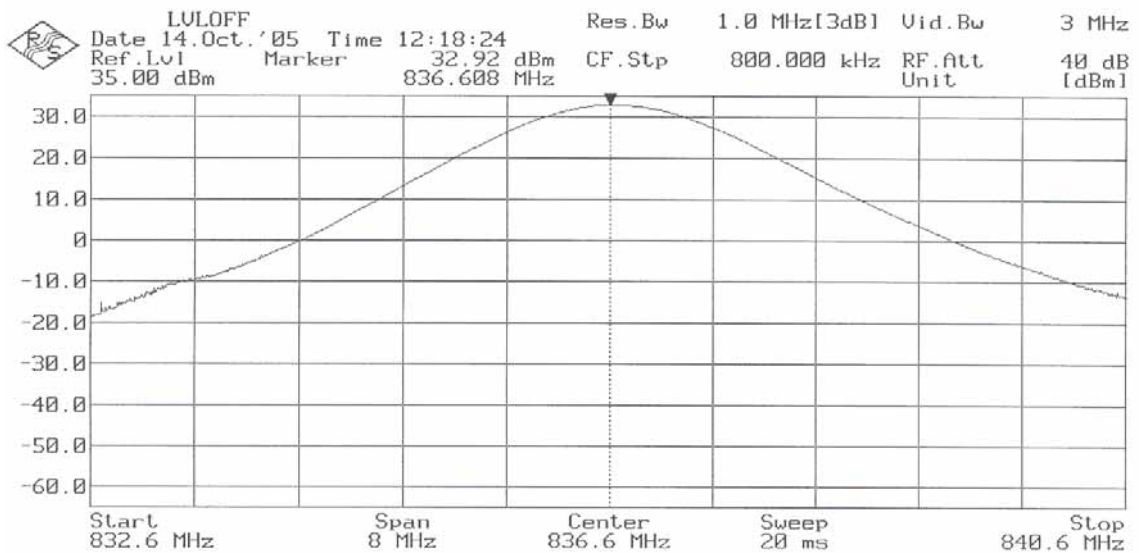
PEAK OUTPUT POWER (CONDUCTED).

Lowest Channel: 824.2 MHz.



PEAK OUTPUT POWER (CONDUCTED).

Middle Channel: 836.6 MHz.



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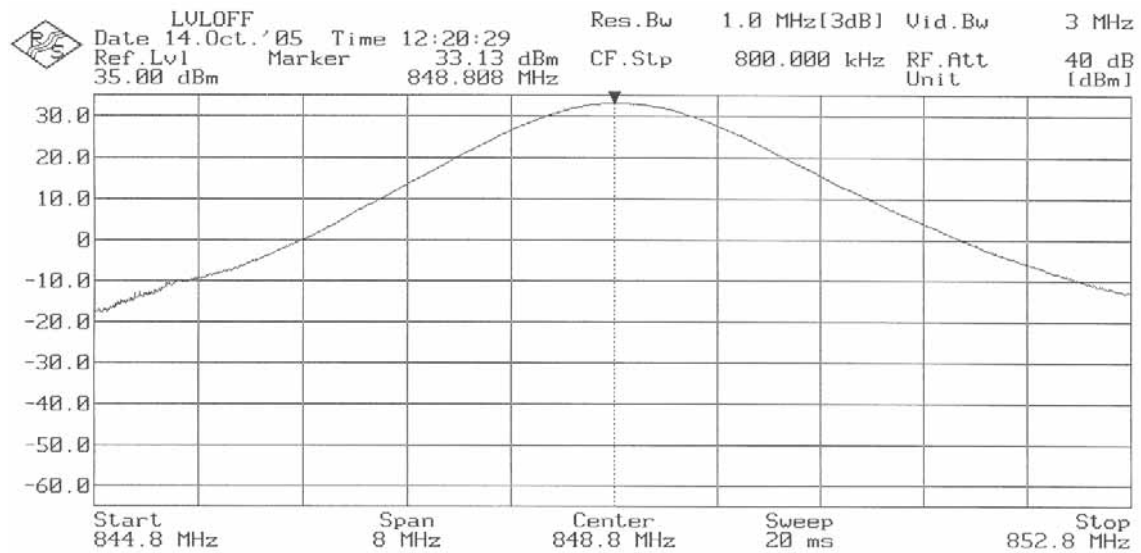
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PEAK OUTPUT POWER (CONDUCTED).

Highest Channel: 848.8 MHz.



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Annex A

Modulation Characteristics

SPECIFICATION

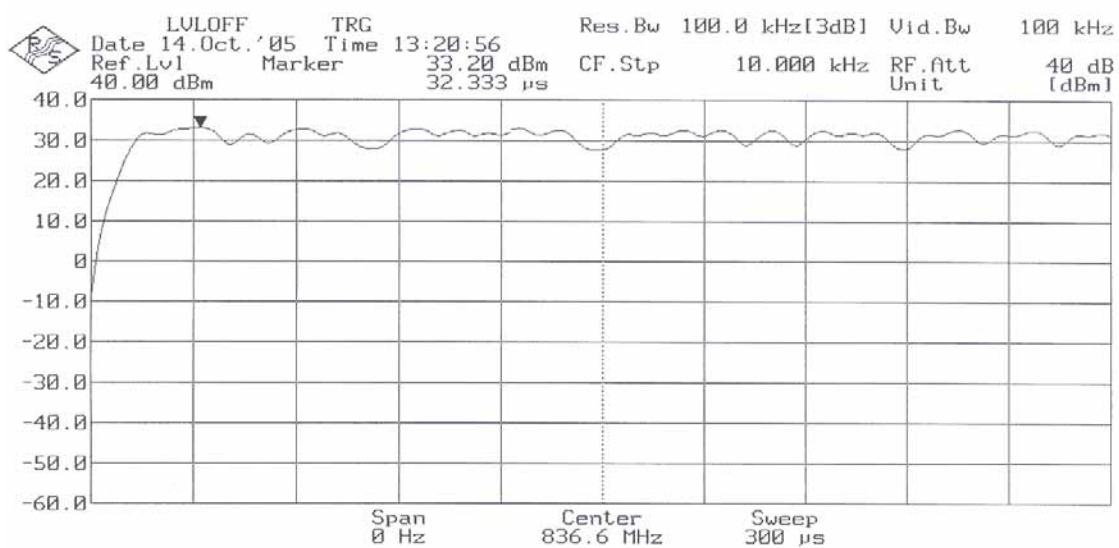
§2.1047

METHOD

The EUT uses GMSK modulation, in which voice or data information is digitized and coded into a bit stream. The bits are conveyed through precise phase changes in the carrier.

RESULTS

The following plot shows the modulation scheme (GMSK) in the EUT.



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Annex A

Frequency Stability

SPECIFICATION

§2.1055 and 22.355

METHOD

The frequency tolerance measurements over temperature variations were made over the temperature range of -30°C to $+50^{\circ}\text{C}$. The EUT was placed inside a climatic chamber and the temperature was raised hourly in 10°C steps from -30°C up to $+50^{\circ}\text{C}$.

The frequency tolerance measurements over voltage variations were made at room temperature and at the V_{max} and V_{min} supply voltages as declared by the applicant.

The EUT was set in “call mode” in the middle channel 190 (836.6 MHz) using the Universal Radio Communication tester R&S CMU200, and the maximum frequency error was measured using the frequency meter of CMU200.

RESULTS

Frequency stability over temperature variations.

Temperature ($^{\circ}\text{C}$)	Frequency Error (Hz)	Frequency Error (ppm)	Frequency Error (%)
+50	-11	-0.0131	-0.00000131
+40	-9	-0.0108	-0.00000108
+30	-10	-0.0120	-0.00000120
+20	-12	-0.0143	-0.00000143
+10	-12	-0.0143	-0.00000143
0	-11	-0.0131	-0.00000131
-10	-12	-0.0143	-0.00000143
-20	-11	-0.0131	-0.00000131
-30	-14	-0.0167	-0.00000167

Frequency stability over voltage variations.

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)	Frequency Error (%)
Vmax	4.2	-12	-0.0143	-0.00000143
Vmin	3.4	-10	-0.0120	-0.00000120

Verdict: PASS

Occupied Bandwidth

SPECIFICATION

§2.1049

METHOD

The EUT was configured to transmit a GMSK modulated carrier signal. An IF bandwidth of 10 kHz was used to determine the occupied bandwidth of the modulated emission.

RESULTS

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	283.3	290.0	288.8
Measurement uncertainty (Hz)	±11		

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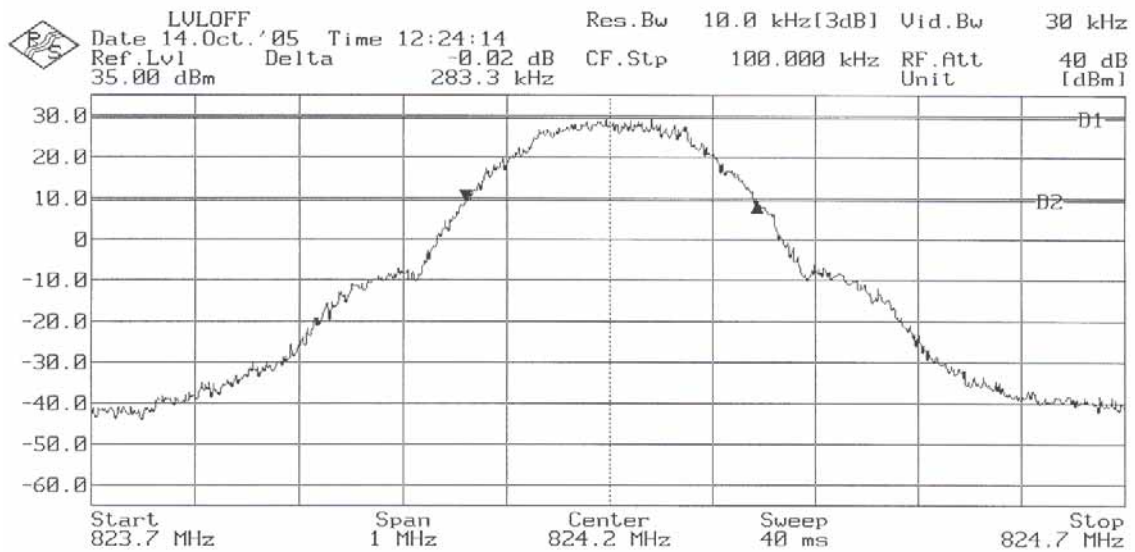
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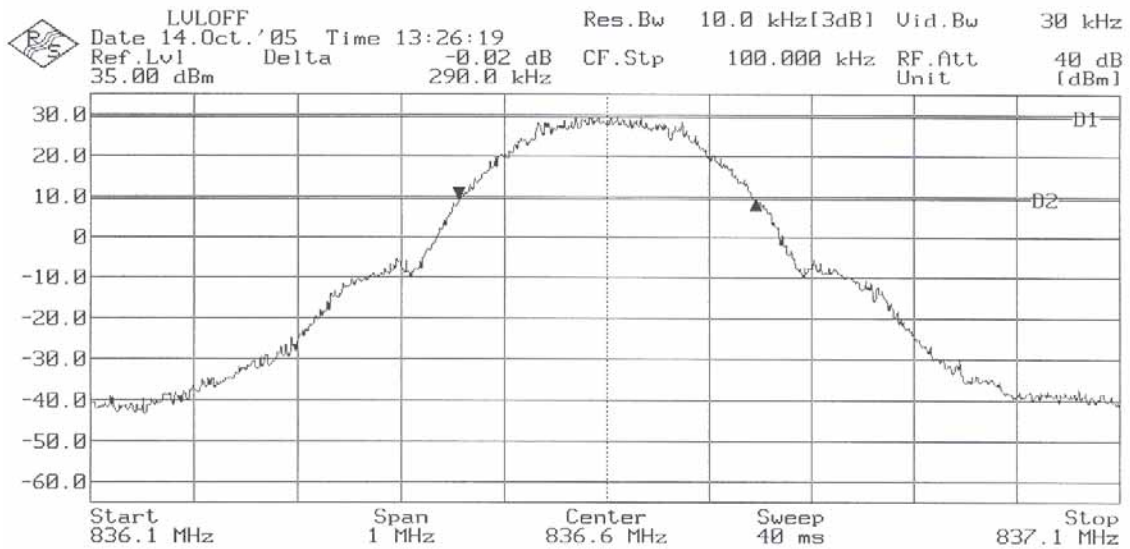
99% OCCUPIED BANDWIDTH

Lowest Channel: 824.2 MHz.



99% OCCUPIED BANDWIDTH

Middle Channel: 836.6 MHz.



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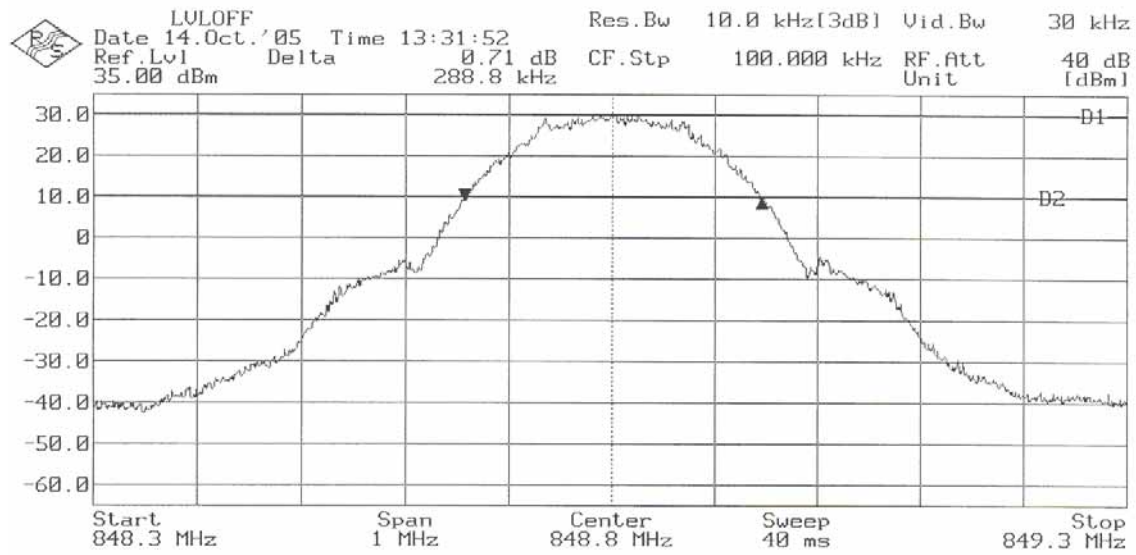
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99% OCCUPIED BANDWIDTH

Highest Channel: 848.8 MHz.



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Annex A

Spurious emissions at antenna terminals

SPECIFICATION

§2.1051 and §22.917

METHOD

The EUT RF output connector was connected to a spectrum analyser using a 50 ohm attenuator and the resolution bandwidth of the spectrum analyser was set to 100 kHz. The spectrum was investigated from 30 MHz to 10 GHz.

The reading of the spectrum analyser is corrected with the attenuation loss of connection between output terminal of EUT and input of the spectrum analyser.

Measurement Limit:

According to specification, the power of emissions shall be attenuated below the transmitter power (P) by a factor of at least $43 + 10 \log (P)$ dB, P in watts.

At P_o transmitting power, the specified minimum attenuation becomes $43 + 10 \log (P_o)$, and the level in dBm relative P_o becomes:

$$P_o \text{ (dBm)} - [43 + 10 \log (P_o \text{ in mwatts}) + 30] = -13 \text{ dBm}$$

RESULTS (see plots in next pages)

1. CHANNEL: LOWEST (824.2 MHz).

Carrier level (dBm) = 32.47

Spurious frequency (MHz)	Level (dBm)	Attenuation below carrier (dBc)
2472.800	-20.61	53.08

2. CHANNEL: MIDDLE (836.6 MHz).

Carrier level (dBm) = 32.92

Spurious frequency (MHz)	Level (dBm)	Attenuation below carrier (dBc)
2509.980	-20.78	53.70
4182.710	-27.34	60.26

3. CHANNEL: HIGHEST (848.8 MHz).

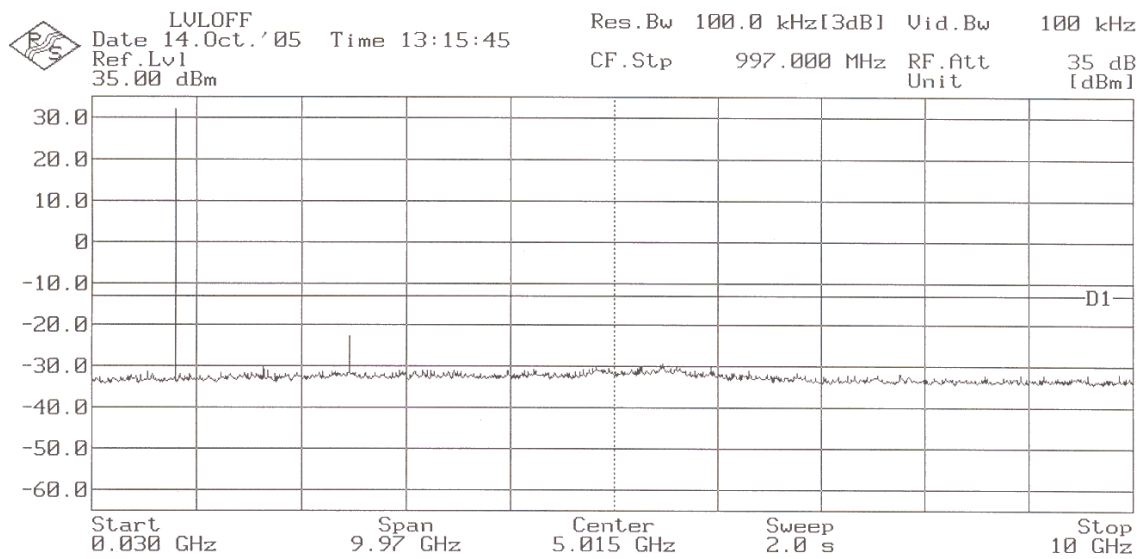
Carrier level (dBm) = 33.13

Spurious frequency (MHz)	Level (dBm)	Attenuation below carrier (dBc)
2546.600	-19.39	52.52

Verdict: PASS

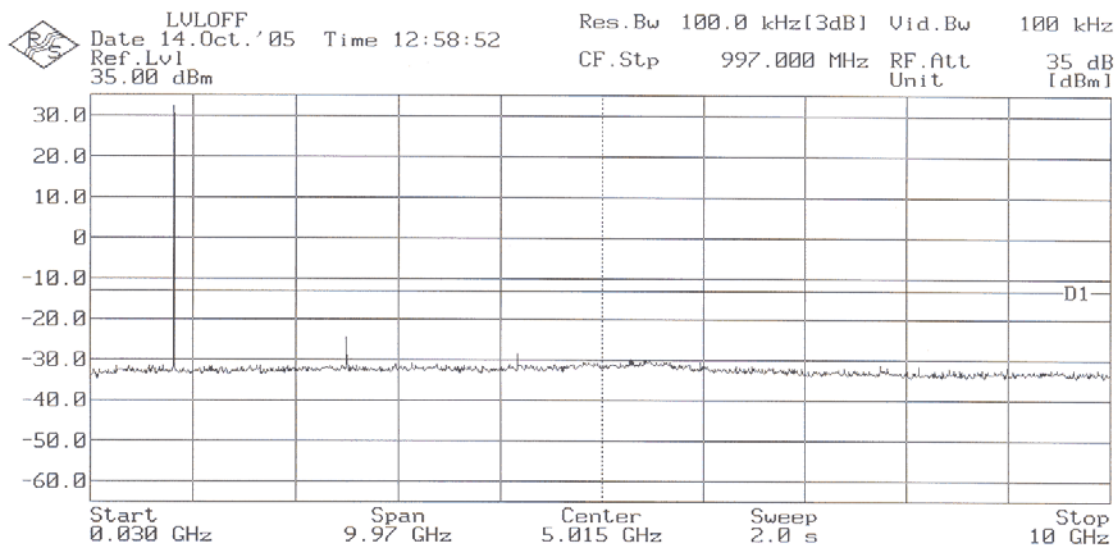
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1. CHANNEL: LOWEST (824.2 MHz).



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

2. CHANNEL: MIDDLE (836.6 MHz).



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

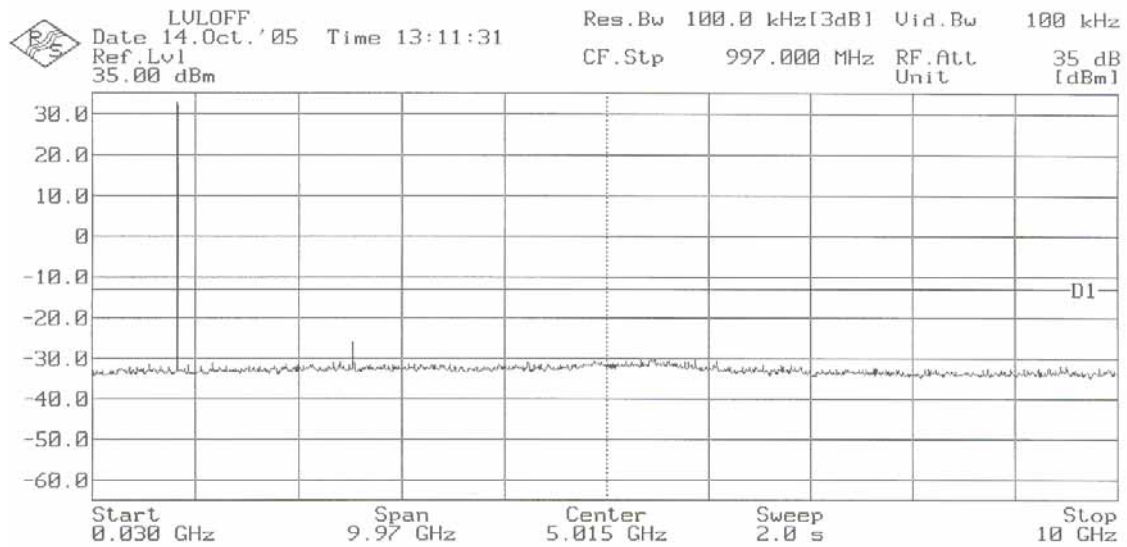
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3. CHANNEL: HIGHEST (848.8 MHz).



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

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Annex A

Spurious emissions at antenna terminals at Block Edges

SPECIFICATION

§2.1051 and §22.917

METHOD

As indicated in FCC part 22, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A resolution bandwidth of 3 kHz was used.

Measurement Limit:

According to specification, the power of emissions shall be attenuated below the transmitter power (P) by a factor of at least $43 + 10 \log (P)$ dB, P in watts.

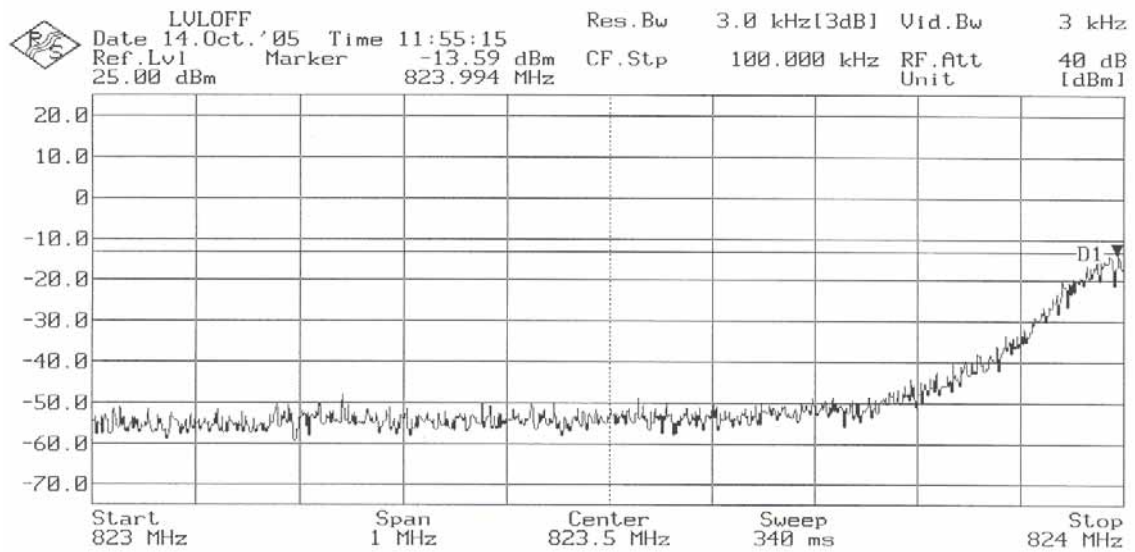
At P_o transmitting power, the specified minimum attenuation becomes $43 + 10 \log (P_o)$, and the level in dBm relative P_o becomes:

$$P_o \text{ (dBm)} - [43 + 10 \log (P_o \text{ in mwatts}) + 30] = -13 \text{ dBm}$$

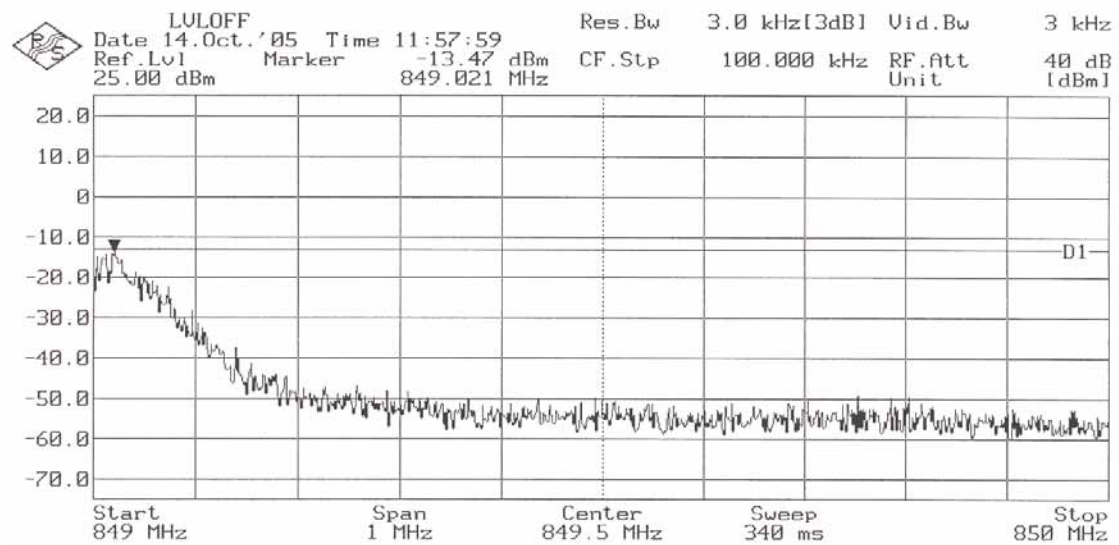
RESULTS (see plots in next pages)

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BLOCK A. CHANNEL LOWEST (824.2 MHz).



BLOCK B. CHANNEL HIGHEST (848.8 MHz).



Verdict: PASS

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Annex A

Radiated emissions

SPECIFICATION

§ 22.917

METHOD

The measurement was performed with the EUT inside an anechoic chamber. The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment.

The EUT was placed on a 1 meter high non-conductive stand at a 3 meter distance from the measuring antenna for measurements below 1 GHz and at 1 m distance for measurements above 1 GHz.

Detected emissions were maximized at each frequency by rotating the EUT and adjusting the measuring antenna height and polarization. The maximum meter reading was recorded. The radiated emissions were measured with peak detector and 1 MHz bandwidth.

Each detected emissions were substituted by the Substitution method, in accordance with the TIA/EIA 603 .

Measurement Limit:

According to specification, the power of emissions shall be attenuated below the transmitter power (P) by a factor of at least $43 + 10 \log (P)$ dB, P in watts.

At P_o transmitting power, the specified minimum attenuation becomes $43 + 10 \log (P_o)$, and the level in dBm relative P_o becomes:

$$P_o \text{ (dBm)} - [43 + 10 \log (P_o \text{ in mwatts}) + 30] = - 13 \text{ dBm}$$

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RESULTS

1. CHANNEL: LOWEST (824.2MHz).

Frequency range 30 MHz-1000 MHz.

No spurious signals were found in all the range.

Frequency range 1 GHz-12.75 GHz.

Carrier level (dBm) = 32.28

Spurious frequency (MHz)	Level (dBm)	Polarization	Attenuation below carrier (dBc)
1648.379	-22.24	Vertical	54.52
2472.629	-19.04	Vertical	51.32
3296.874	-37.70	Vertical	69.98

2. CHANNEL: MIDDLE (836.6 MHz).

Frequency range 30 MHz-1000 MHz.

No spurious signals were found in all the range.

Frequency range 1 GHz-12.75 GHz.

Carrier level (dBm) = 31.84

Spurious frequency (MHz)	Level (dBm)	Polarization	Attenuation below carrier (dBc)
1673.372	-33.00	Vertical	64.84
2509.916	-22.85	Vertical	54.69
3346.679	-38.08	Vertical	69.92

3. CHANNEL: HIGHEST (848.8 MHz).

Frequency range 30 MHz-1000 MHz.

No spurious signals were found in all the range.

Frequency range 1 GHz-12.75 GHz.

Carrier level (dBm) = 31.95

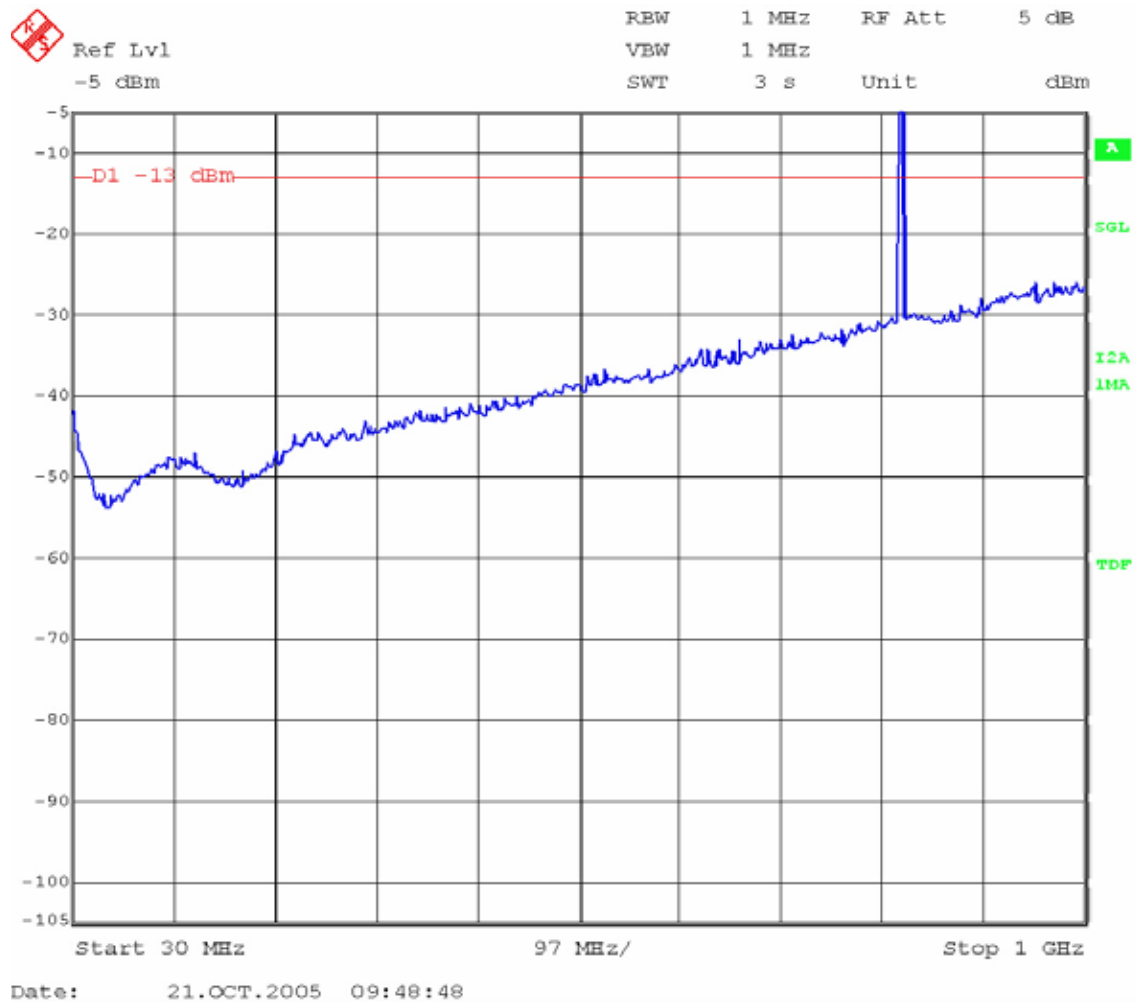
Spurious frequency (MHz)	Level (dBm)	Polarization	Attenuation below carrier (dBc)
1697.633	-33.69	Vertical	65.64
2546.175	-21.20	Vertical	53.15
3395.200	-39.17	Vertical	71.12
4244.130	-39.86	Vertical	71.81

Verdict: PASS

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FREQUENCY RANGE 30 MHz-1000 MHz.

CHANNEL: LOWEST (824.2 MHz)



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

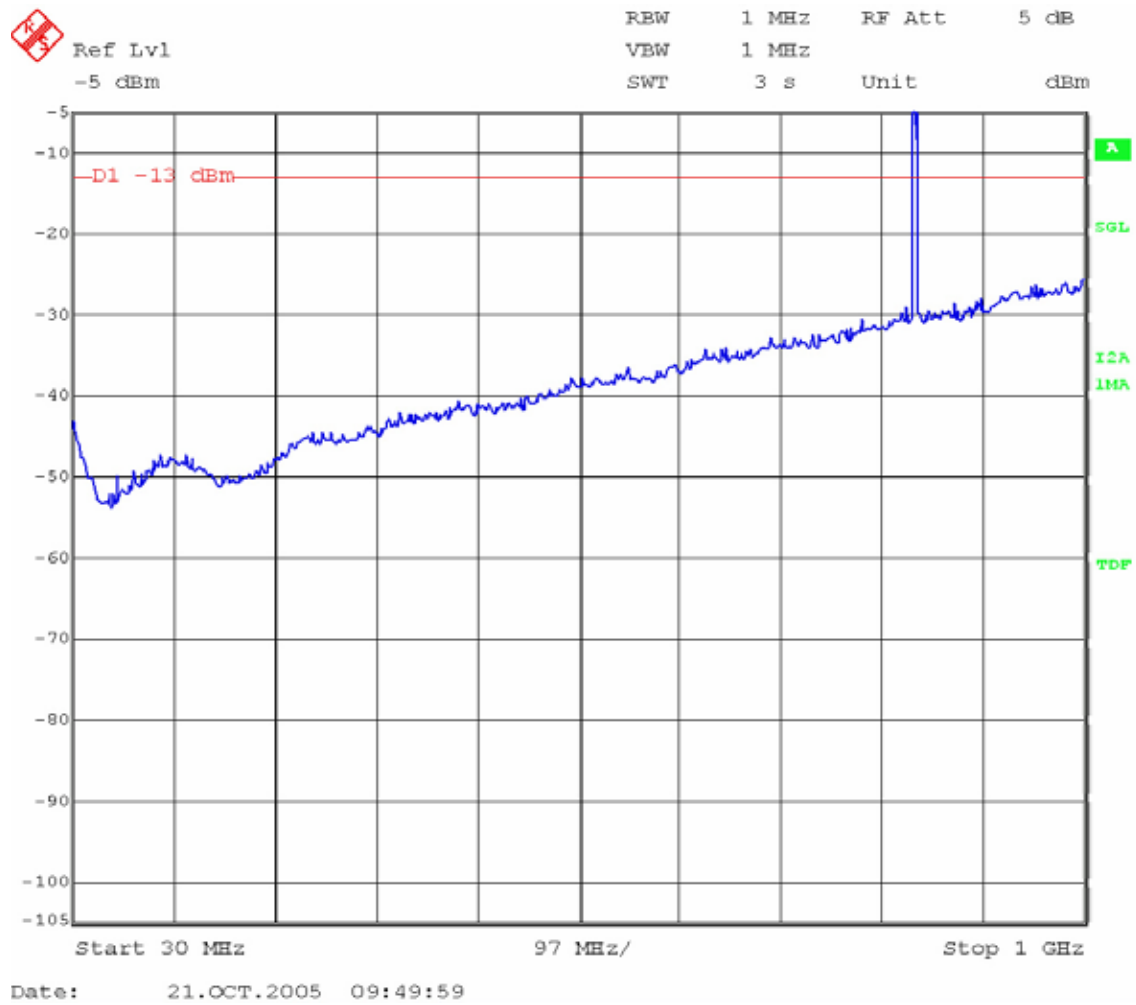
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CHANNEL: MIDDLE (836.6 MHz)



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

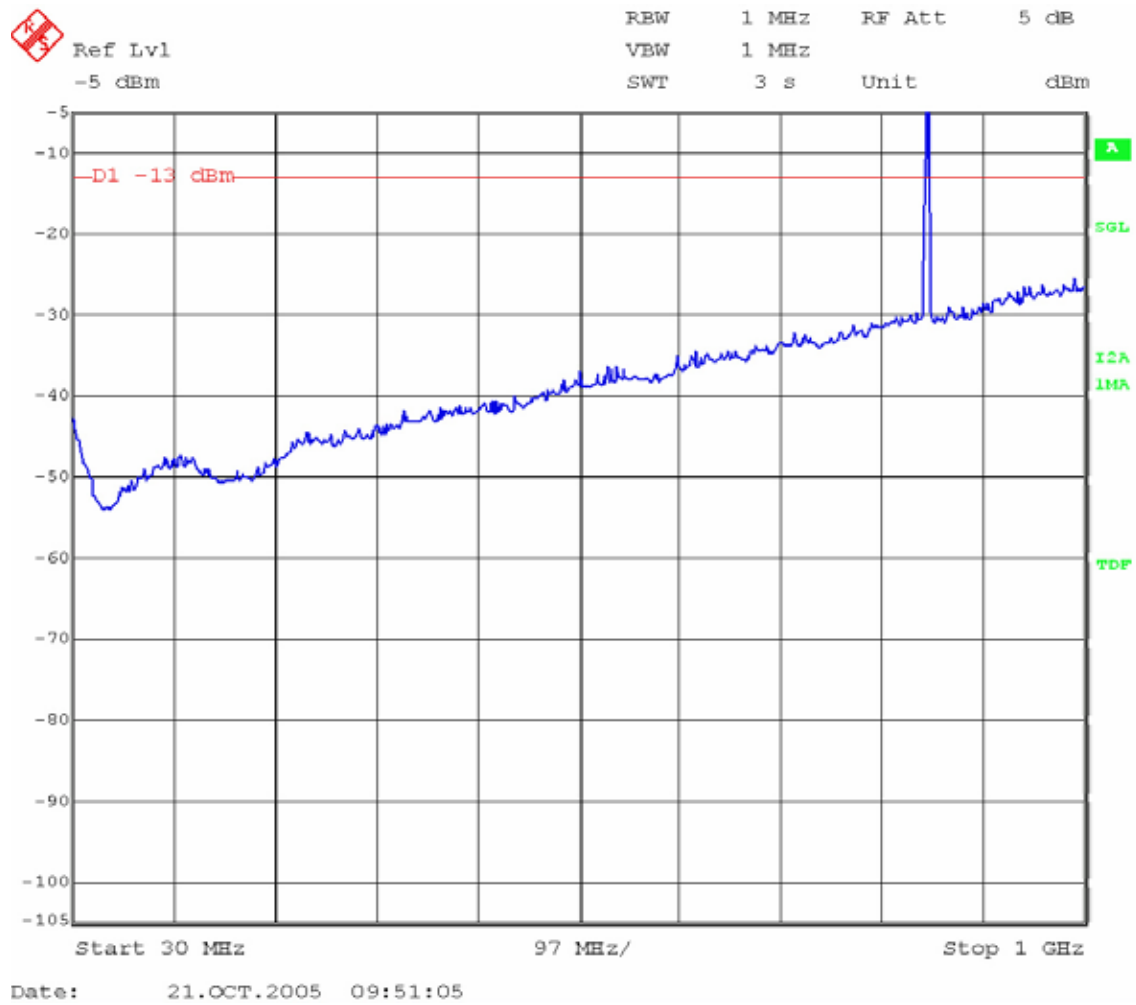
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CHANNEL: HIGHEST (848.8 MHz)



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

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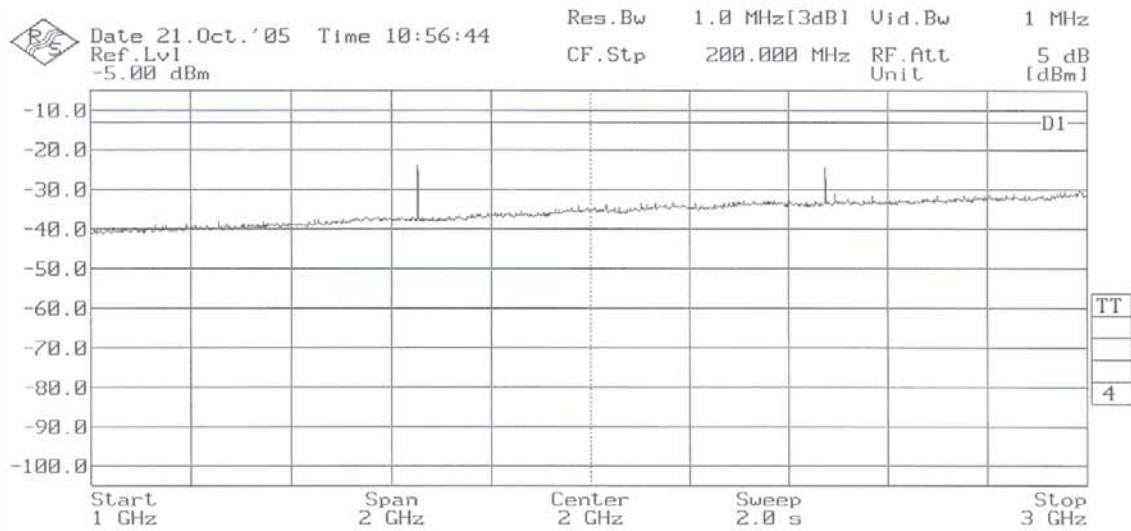
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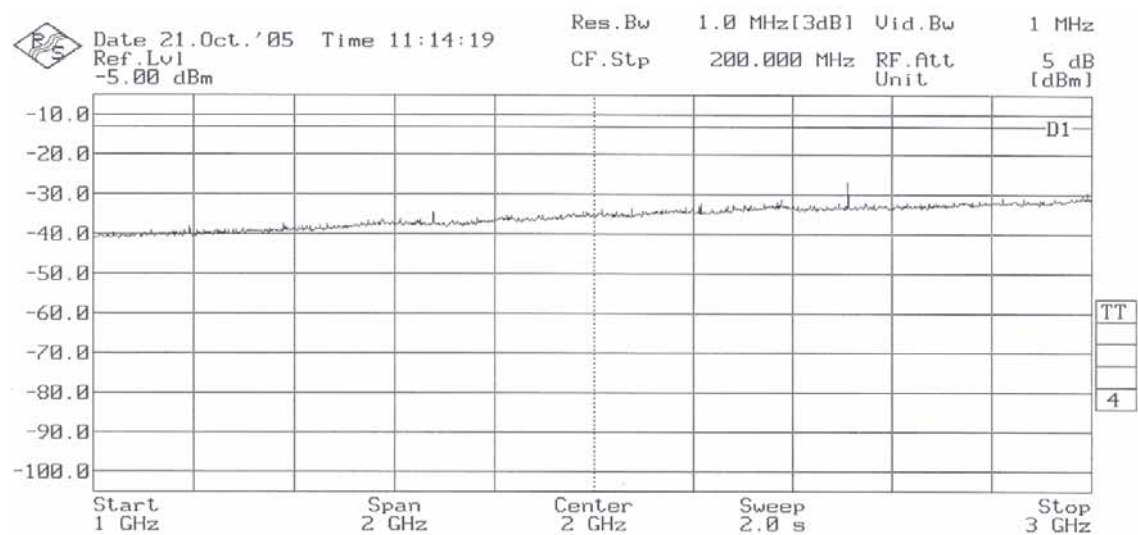
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FREQUENCY RANGE 1 GHz to 3 GHz.

CHANNEL: LOWEST (824.2 MHz)



CHANNEL: MIDDLE (836.6 MHz)



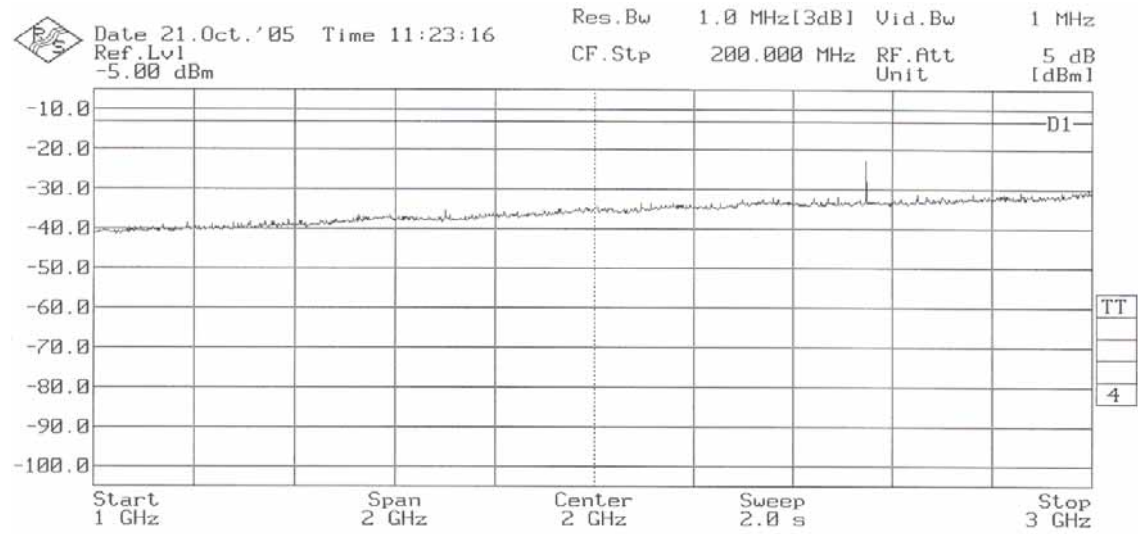
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CHANNEL: HIGHEST (848.8 MHz)



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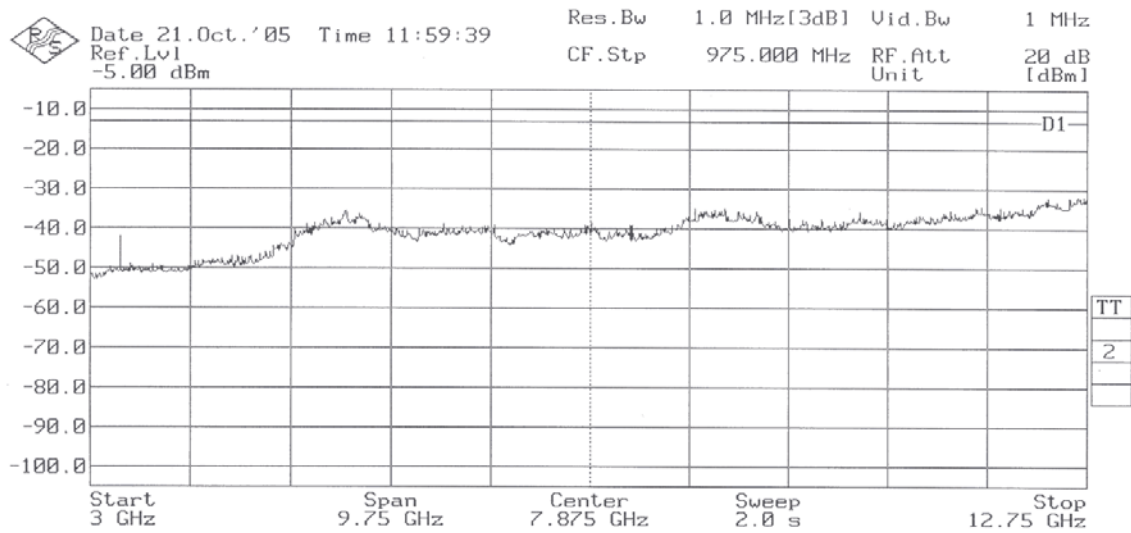
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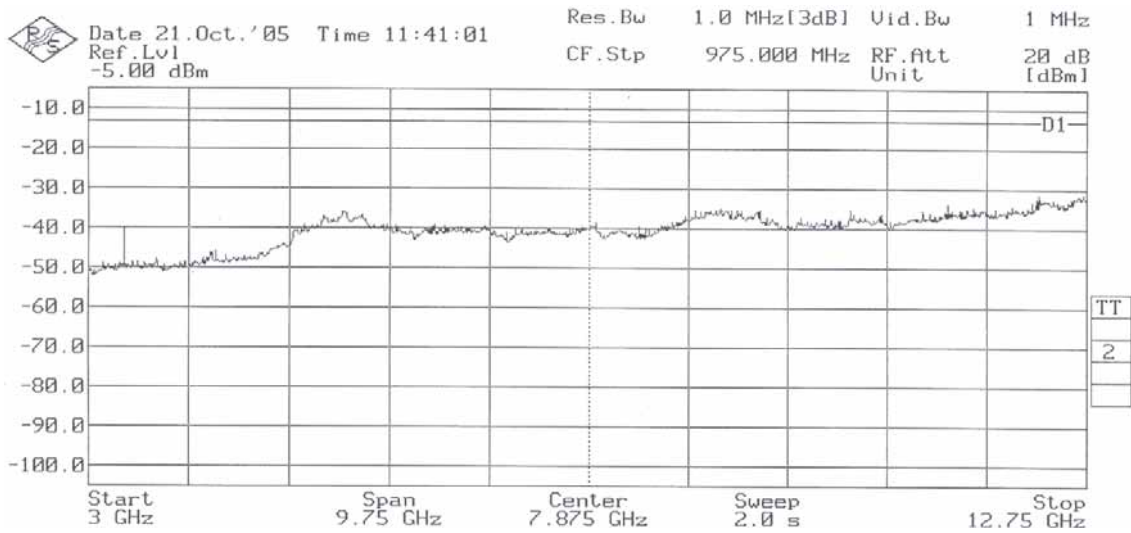
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FREQUENCY RANGE 3 GHz to 12.75 GHz.

CHANNEL: LOWEST (824.2 MHz)



CHANNEL: MIDDLE (836.6 MHz)



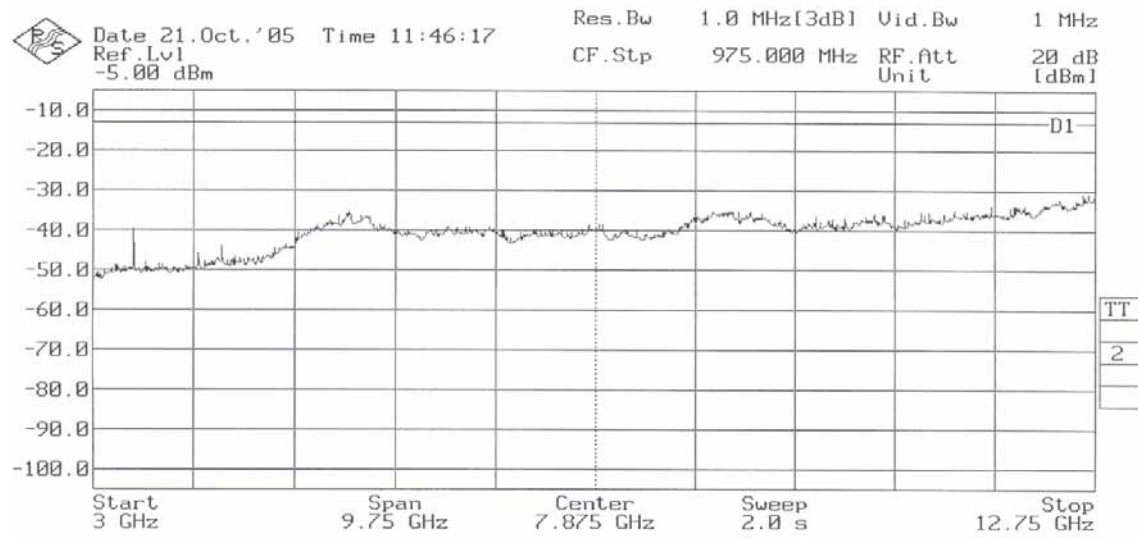
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CHANNEL: HIGHEST (848.8 MHz)



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ANNEX B

TEST RESULTS FOR FCC PART 24

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Annex B

TEST CONDITIONS

Power supply (V):

$$V_{\text{nom}} = 3.8 \text{ Vdc}$$

$$V_{\text{max}} = 4.2 \text{ Vdc}$$

$$V_{\text{min}} = 3.4 \text{ Vdc}$$

The subscripts nom, min and max indicates voltage test conditions (nominal, minimum and maximum respectively, as declared by the applicant).

Type of power supply = DC Voltage from external power supply

Type of antenna = external connectable antenna with sma connector

TEST FREQUENCIES:

Lowest channel (512): 1850.2 MHz

Middle channel (662): 1880.2 MHz

Highest channel (810): 1909.8 MHz

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RF Output Power (conducted and E.I.R.P.)

SPECIFICATION

§2.1046 and 24.232

METHOD

The conducted RF output power measurements were made at the RF output terminals of the EUT using an attenuator, power splitter and spectrum analyser. The EUT was controlled via the Universal Radio Communication tester R&S CMU200 selecting maximum transmission power of the EUT and GMSK modulated signal.

For radiated measurements the EUT was placed on a 1 m high non-conductive stand inside an anechoic chamber. The measuring antenna was placed at 1 m distance and the maximum field strength was measured for the three channels. The EUT was controlled via the Universal Radio Communication tester R&S CMU200 selecting maximum transmission power of the EUT and GMSK modulated signal.

The Effective Isotropic Radiated Power (E.I.R.P.) is obtained by using the Substitution Method according to ANSI/TIA/EIA-603-A.

RESULTS

MAXIMUM OUTPUT POWER (CONDUCTED). See plots in next pages.

Channel	Lowest	Middle	Highest
Maximum peak power (dBm)	29.55	28.73	29.19
Maximum peak power (W)	0.90	0.75	0.83
Measurement uncertainty (dB)	±1.5		

MAXIMUM EQUIVALENT ISOTROPIC RADIATED POWER E.I.R.P. (RADIATED).

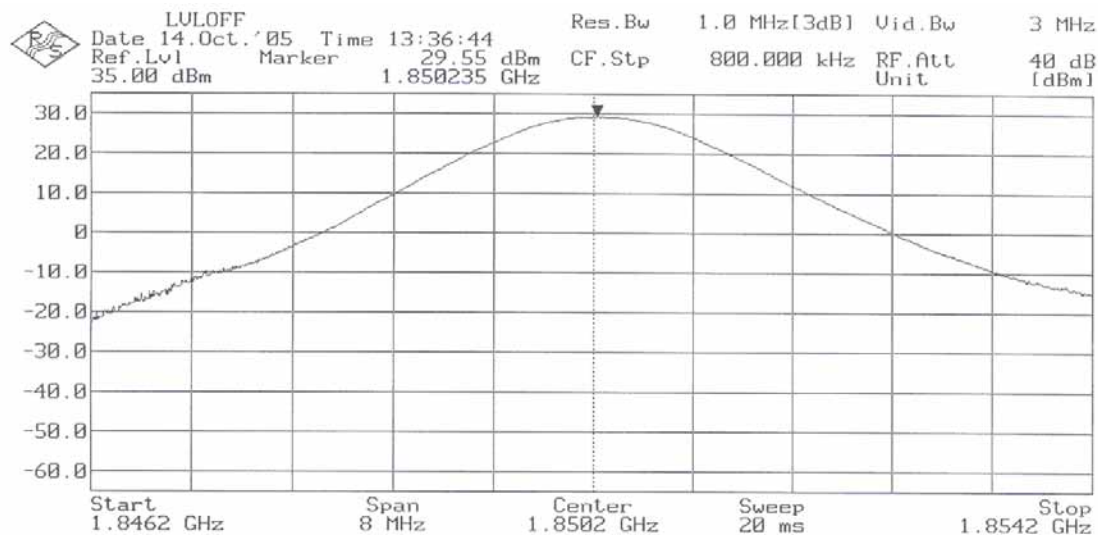
Channel	Lowest	Middle	Highest
Maximum peak power (dBm)	24.14	24.72	25.51
Maximum peak power (W)	0.26	0.30	0.36
Measurement uncertainty (dB)	± 4.0		

Verdict: PASS

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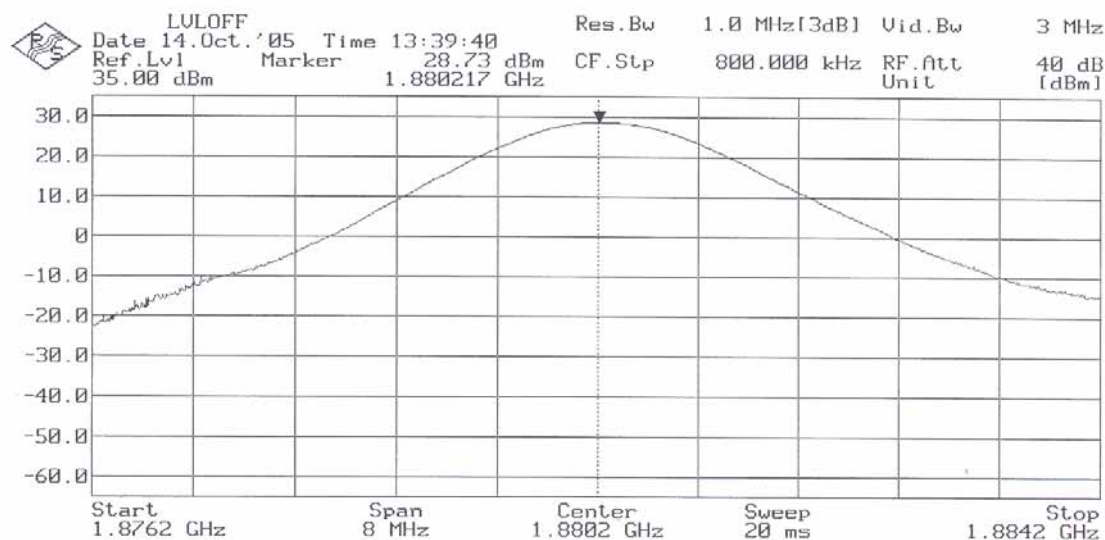
PEAK OUTPUT POWER (CONDUCTED).

Lowest Channel: 1850.2 MHz.



PEAK OUTPUT POWER (CONDUCTED).

Middle Channel: 1880.2 MHz.



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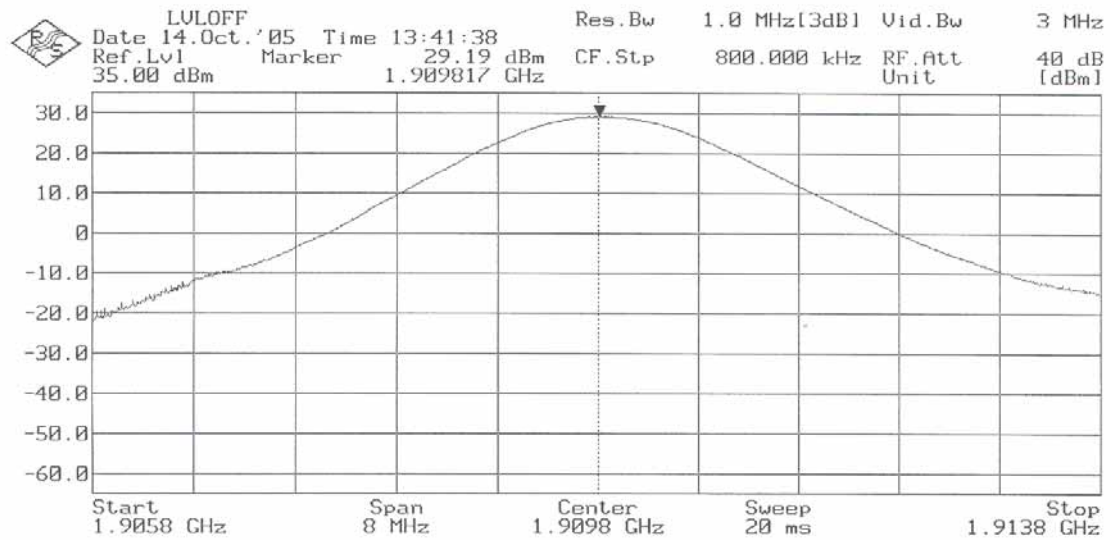
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PEAK OUTPUT POWER (CONDUCTED).

Highest Channel: 1909.8 MHz.



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Modulation Characteristics

SPECIFICATION

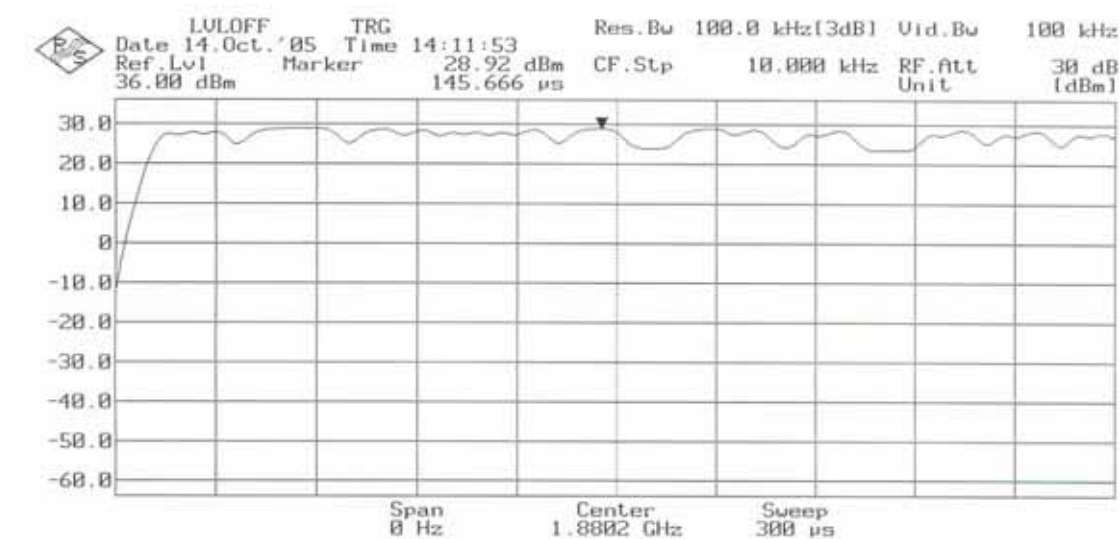
§2.1047

METHOD

The EUT uses GMSK modulation, in which voice or data information is digitized and coded into a bit stream. The bits are conveyed through precise phase changes in the carrier.

RESULTS

The following plot shows the modulation scheme (GMSK) in the EUT.



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Annex B

Frequency Stability

SPECIFICATION

§2.1055 and 24.235

METHOD

The frequency tolerance measurements over temperature variations were made over the temperature range of -30°C to $+50^{\circ}\text{C}$. The EUT was placed inside a climatic chamber and the temperature was raised hourly in 10°C steps from -30°C up to $+50^{\circ}\text{C}$.

The frequency tolerance measurements over voltage variations were made at room temperature and at the V_{max} and V_{min} supply voltages as declared by the applicant.

The EUT was set in “call mode” in the middle channel 662 (1880.2 MHz) using the Universal Radio Communication tester R&S CMU200, and the maximum frequency error was measured using the frequency meter of CMU200.

RESULTS

Frequency stability over temperature variations.

Temperature ($^{\circ}\text{C}$)	Frequency Error (Hz)	Frequency Error (ppm)	Frequency Error (%)
+50	-12	-0.0064	-0.00000064
+40	-9	-0.0048	-0.00000048
+30	-7	-0.0037	-0.00000037
+20	-11	-0.0059	-0.00000059
+10	-13	-0.0069	-0.00000069
0	-15	-0.0080	-0.00000080
-10	-15	-0.0080	-0.00000080
-20	-16	-0.0085	-0.00000085
-30	-13	-0.0069	-0.00000069

Frequency stability over voltage variations.

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)	Frequency Error (%)
V _{max}	4.2	-13	-0.0069	-0.00000069
V _{min}	3.4	-14	-0.0074	-0.00000074

Verdict: PASS

Occupied Bandwidth

SPECIFICATION

§2.1049

METHOD

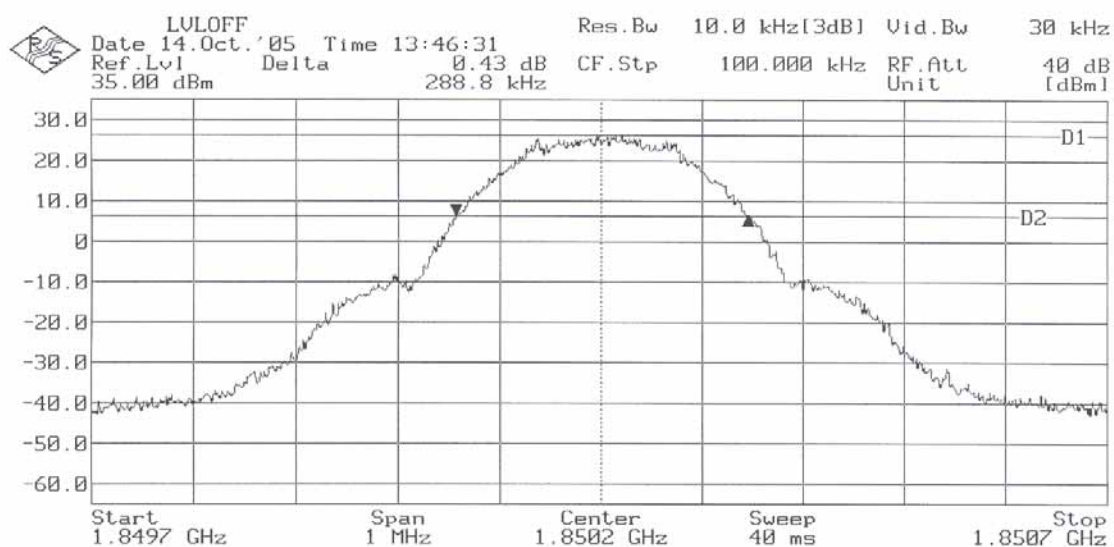
The EUT was configured to transmit a GMSK modulated carrier signal. An IF bandwidth of 10 kHz was used to determine the occupied bandwidth of the modulated emission.

RESULTS

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	288.8	285.5	288.8
Measurement uncertainty (Hz)	±11		

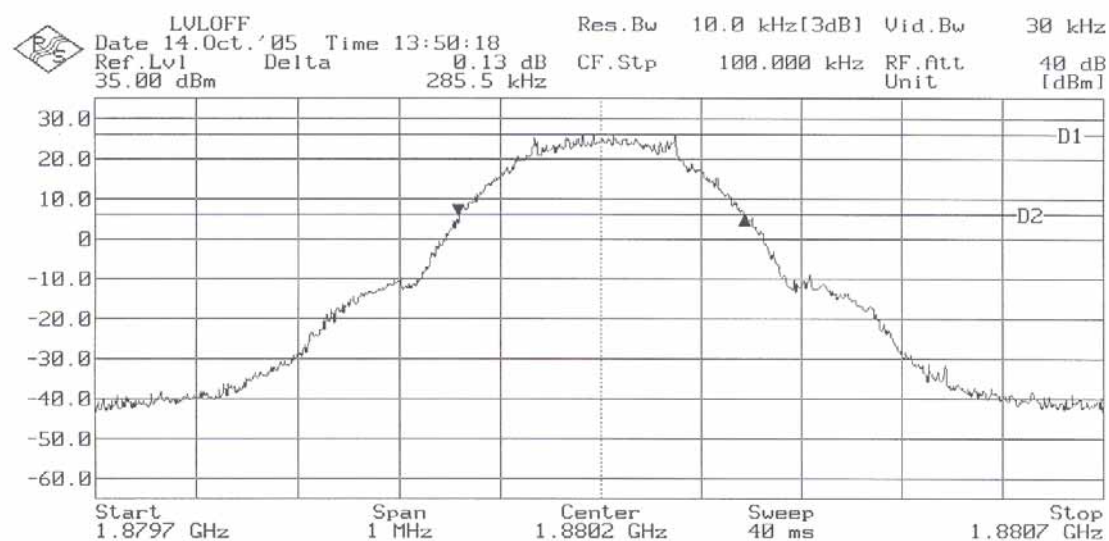
99% OCCUPIED BANDWIDTH

Lowest Channel: 1850.2 MHz.



99% OCCUPIED BANDWIDTH

Middle Channel: 1880.2 MHz.



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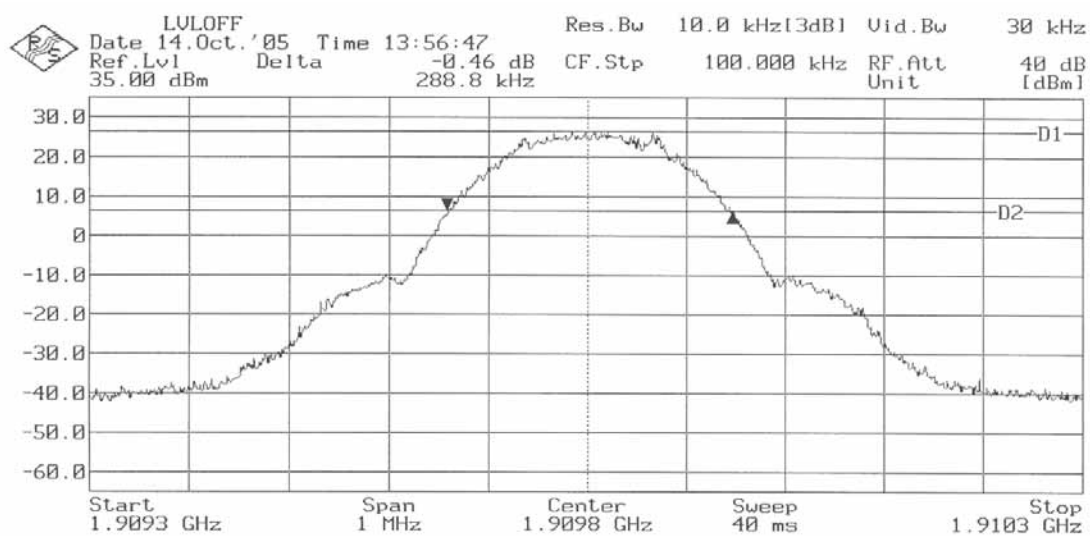
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99% OCCUPIED BANDWIDTH

Highest Channel: 1909.8 MHz.



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Annex B

Spurious emissions at antenna terminals

SPECIFICATION

§2.1051 and §24.238

METHOD

The EUT RF output connector was connected to a spectrum analyser using a 50 ohm attenuator and the resolution bandwidth of the spectrum analyser was set to 1 MHz. The spectrum was investigated from 30 MHz to 20 GHz.

The reading of the spectrum analyser is corrected with the attenuation loss of connection between output terminal of EUT and input of the spectrum analyser.

Measurement Limit:

According to specification, the power of emissions shall be attenuated below the transmitter power (P) by a factor of at least $43 + 10 \log (P)$ dB, P in watts.

At P_o transmitting power, the specified minimum attenuation becomes $43 + 10 \log (P_o)$, and the level in dBm relative P_o becomes:

$$P_o \text{ (dBm)} - [43 + 10 \log (P_o \text{ in mwatts}) + 30] = -13 \text{ dBm}$$

RESULTS (see plots in next pages)

1. CHANNEL: LOWEST (1850.2 MHz).

No spurious signals were found in all the range.

2. CHANNEL: MIDDLE (1880.2 MHz).

No spurious signals were found in all the range.

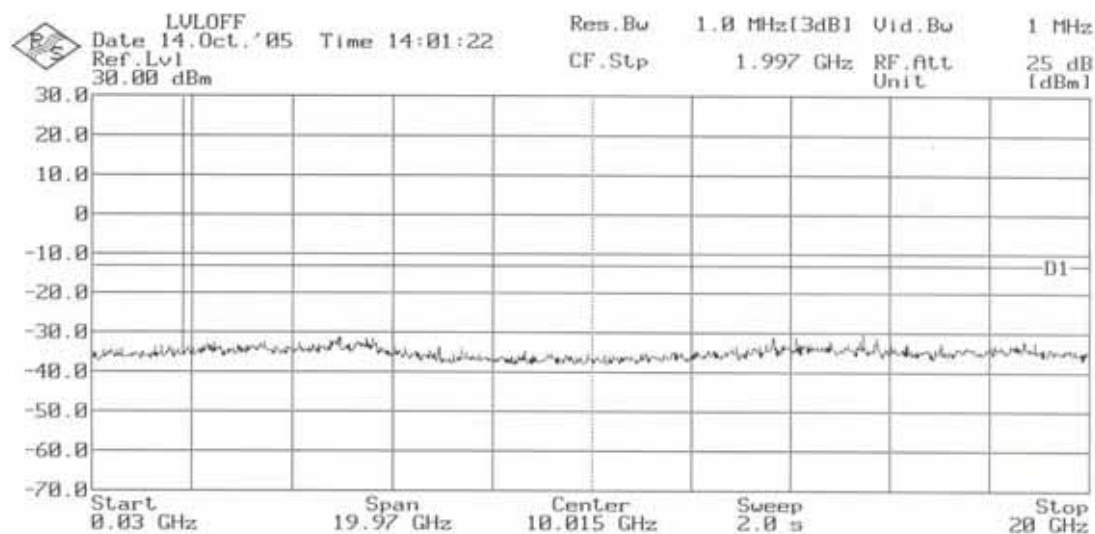
3. CHANNEL: HIGHEST (1909.8 MHz).

No spurious signals were found in all the range.

Verdict: PASS

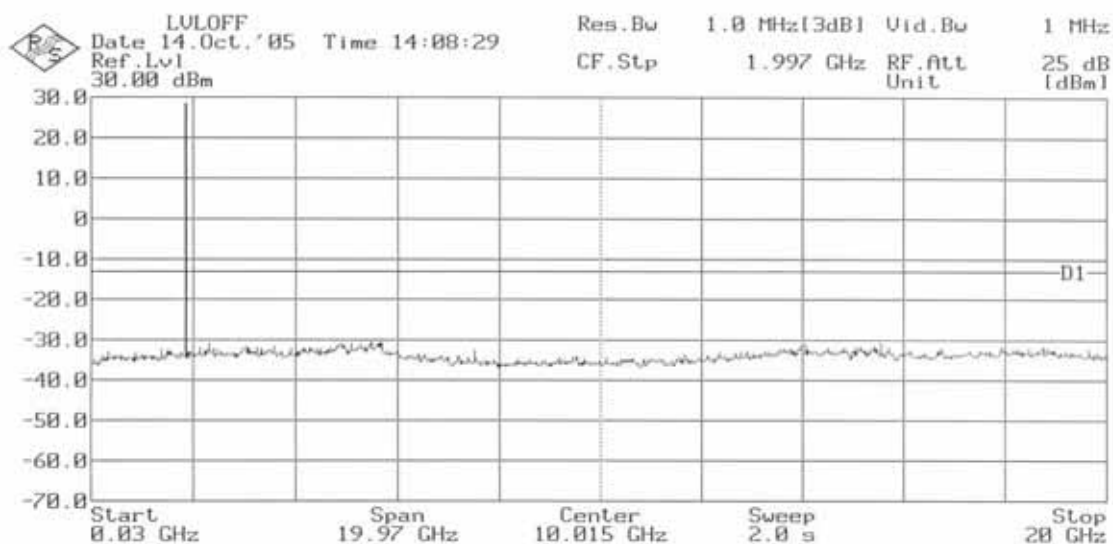
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1. CHANNEL: LOWEST (1850.2 MHz).



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

2. CHANNEL: MIDDLE (1880.2 MHz).



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

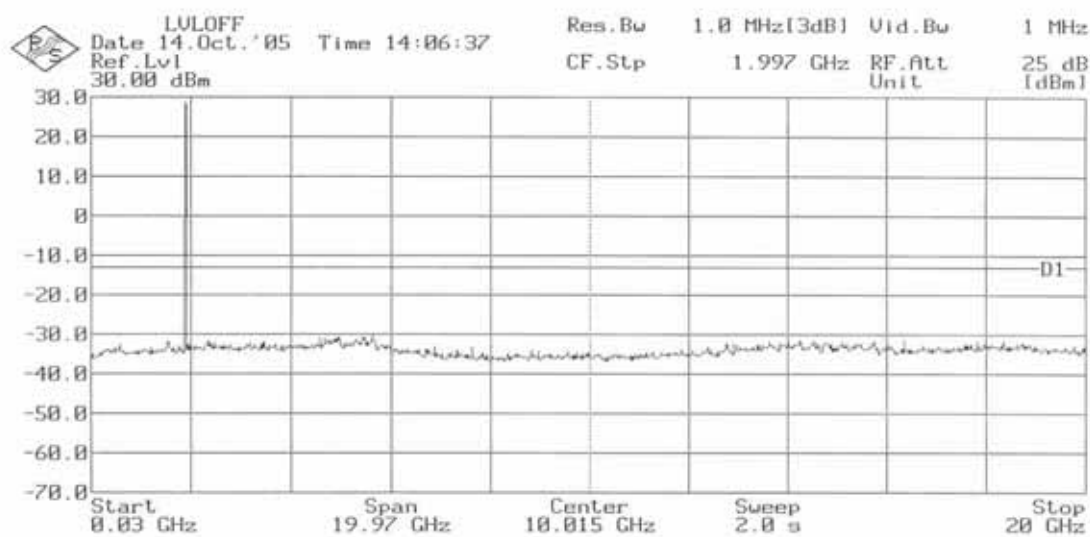
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3. CHANNEL: HIGHEST (1909.8 MHz).



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

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Spurious emissions at antenna terminals at Block Edges

SPECIFICATION

§2.1051 and §24.238

METHOD

As indicated in FCC part 24, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A resolution bandwidth of 3 kHz was used.

Measurement Limit:

According to specification, the power of emissions shall be attenuated below the transmitter power (P) by a factor of at least $43 + 10 \log (P)$ dB, P in watts.

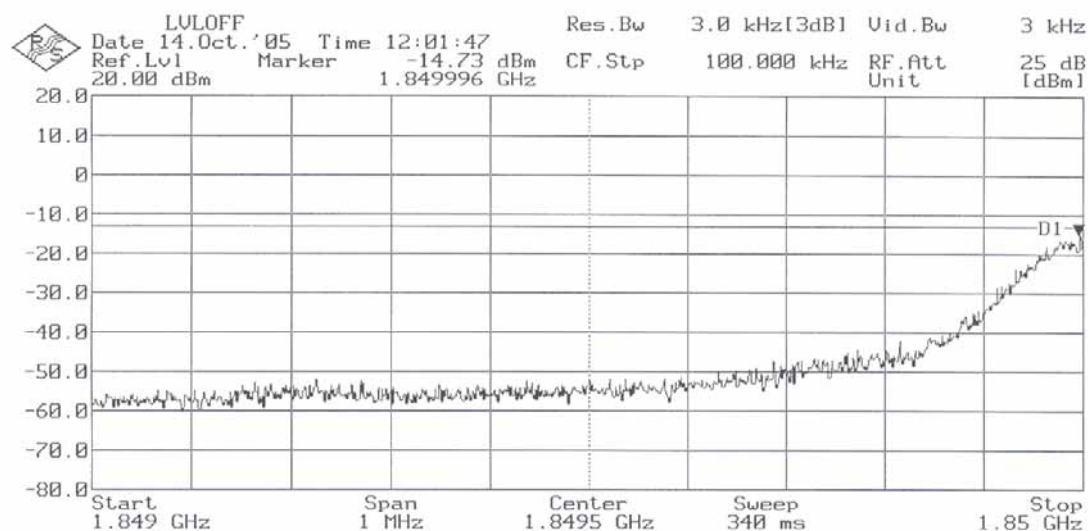
At P_o transmitting power, the specified minimum attenuation becomes $43 + 10 \log (P_o)$, and the level in dBm relative P_o becomes:

$$P_o \text{ (dBm)} - [43 + 10 \log (P_o \text{ in mwatts}) + 30] = -13 \text{ dBm}$$

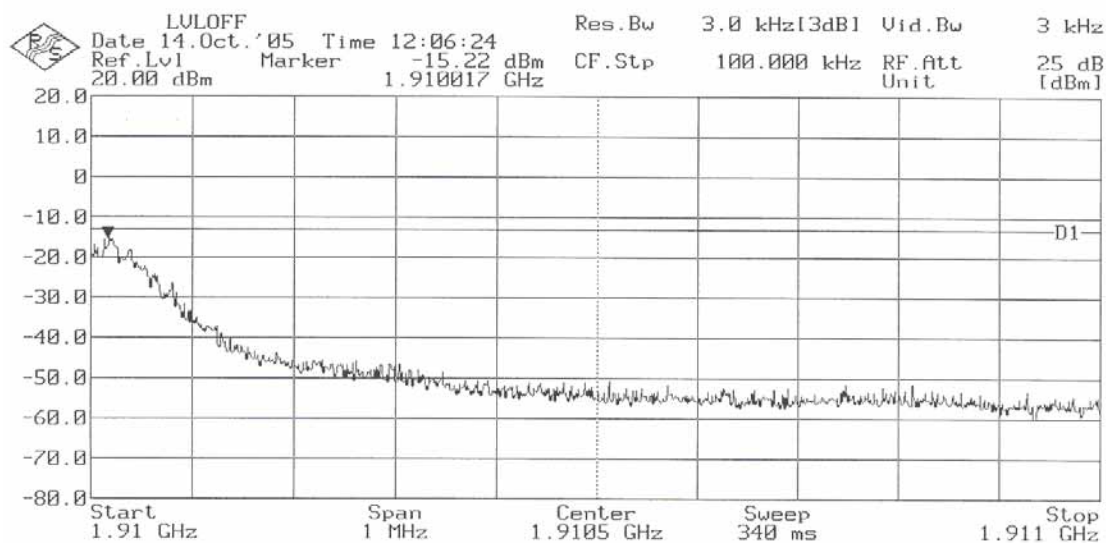
RESULTS (see plots in next pages)

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BLOCK A. CHANNEL LOWEST (1850.2 MHz).



BLOCK C. CHANNEL HIGHEST (1909.8 MHz).



Verdict: PASS

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Annex B

Radiated emissions

SPECIFICATION

§ 24.238

METHOD

The measurement was performed with the EUT inside an anechoic chamber. The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment.

The EUT was placed on a 1 meter high non-conductive stand at a 3 meter distance from the measuring antenna for measurements below 1 GHz and at 1 m distance for measurements above 1 GHz.

Detected emissions were maximized at each frequency by rotating the EUT and adjusting the measuring antenna height and polarization. The maximum meter reading was recorded. The radiated emissions were measured with peak detector and 1 MHz bandwidth.

Each detected emissions were substituted by the Substitution method, in accordance with the TIA/EIA 603 .

Measurement Limit:

According to specification, the power of emissions shall be attenuated below the transmitter power (P) by a factor of at least $43 + 10 \log (P)$ dB, P in watts.

At P_o transmitting power, the specified minimum attenuation becomes $43 + 10 \log (P_o)$, and the level in dBm relative P_o becomes:

$$P_o \text{ (dBm)} - [43 + 10 \log (P_o \text{ in mwatts}) + 30] = - 13 \text{ dBm}$$

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RESULTS

1. CHANNEL: LOWEST (1850.2MHz).

Frequency range 30 MHz-1000 MHz.

No spurious signals were found in all the range.

Frequency range 1 GHz-20 GHz.

Carrier level (dBm) = 24.14

Spurious frequency (MHz)	Level (dBm)	Polarization	Attenuation below carrier (dBc)
3700.616	-42.48	Vertical	66.62
7400.599	-40.70	Vertical	64.84
11100.808	-39.38	Vertical	63.52

2. CHANNEL: MIDDLE (1880.2 MHz).

Frequency range 30 MHz-1000 MHz.

No spurious signals were found in all the range.

Frequency range 1 GHz-20 GHz.

Carrier level (dBm) = 24.72

Spurious frequency (MHz)	Level (dBm)	Polarization	Attenuation below carrier (dBc)
3760.574	-50.45	Vertical	75.17
7521.145	-36.66	Vertical	61.38

3. CHANNEL: HIGHEST (1909.8 MHz).

Frequency range 30 MHz-1000 MHz.

No spurious signals were found in all the range.

Frequency range 1 GHz-20 GHz.

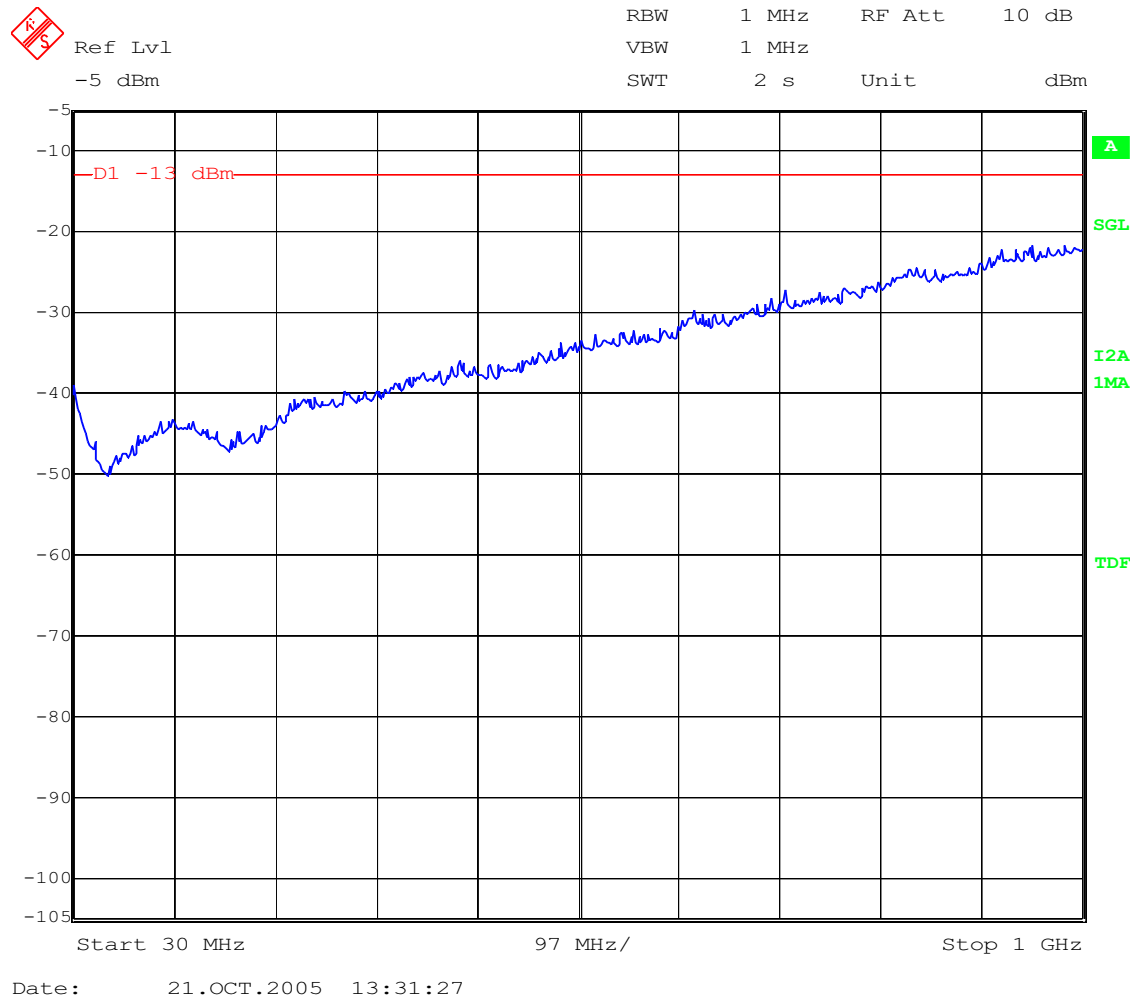
Carrier level (dBm) = 25.51

Spurious frequency (MHz)	Level (dBm)	Polarization	Attenuation below carrier (dBc)
3819.560	-44.80	Vertical	70.31
7638.970	-36.60	Vertical	62.11

Verdict: PASS

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FREQUENCY RANGE 30 MHz-1000 MHz.

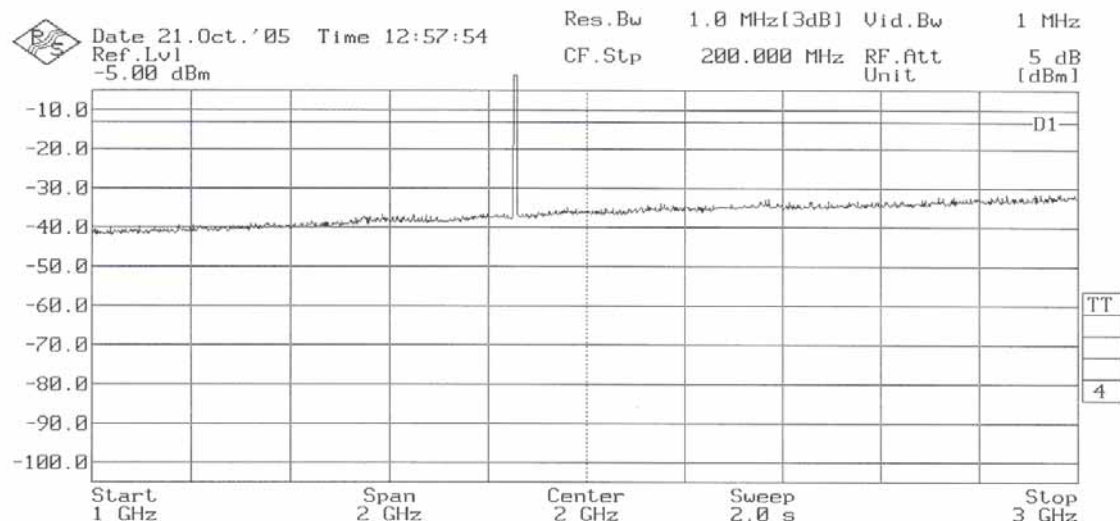


(This plot is valid for all three channels).

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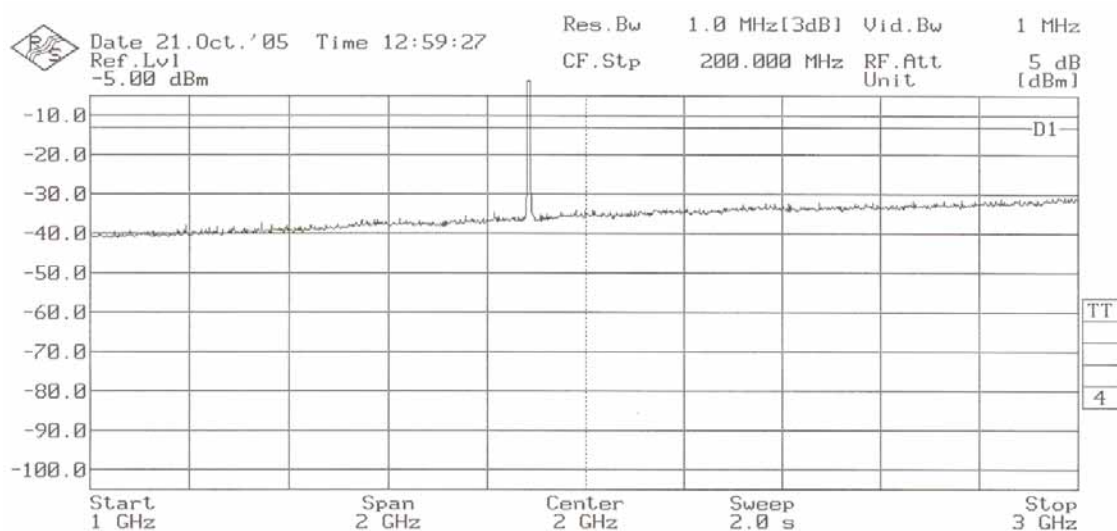
FREQUENCY RANGE 1 GHz to 3 GHz.

CHANNEL: LOWEST (1850.2 MHz)



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

CHANNEL: MIDDLE (1880.2 MHz)



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

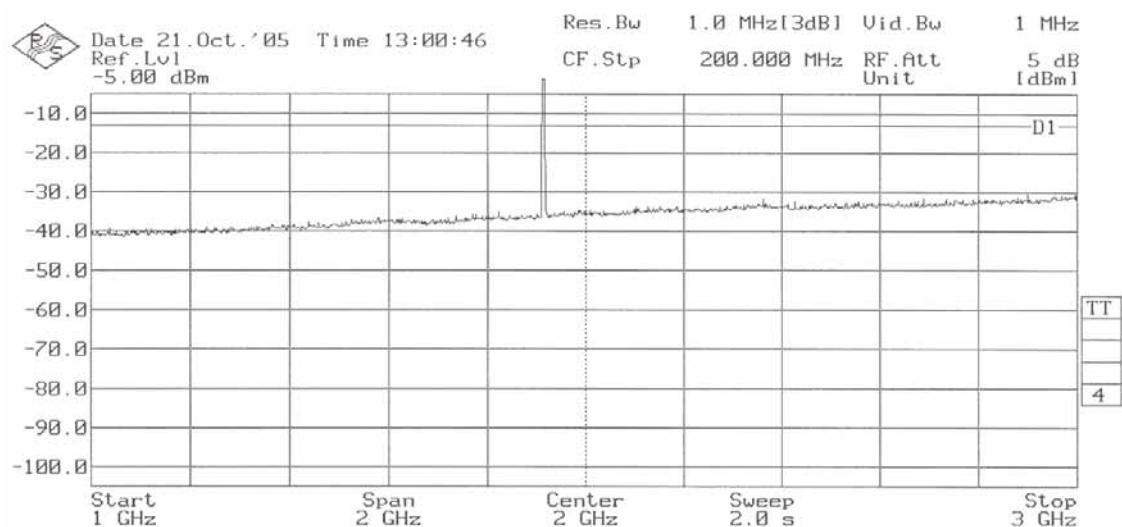
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CHANNEL: HIGHEST (1909.8 MHz)



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

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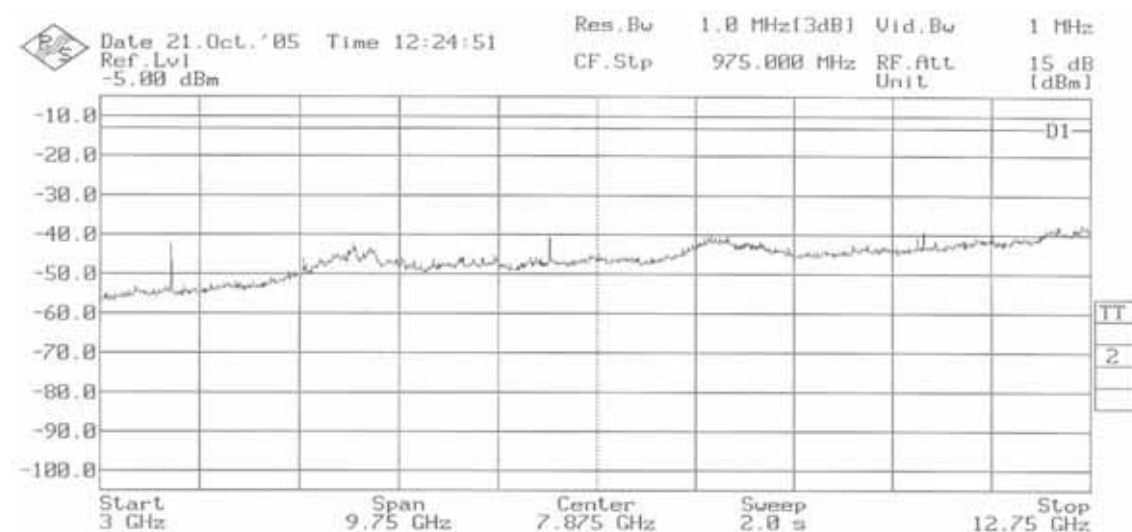
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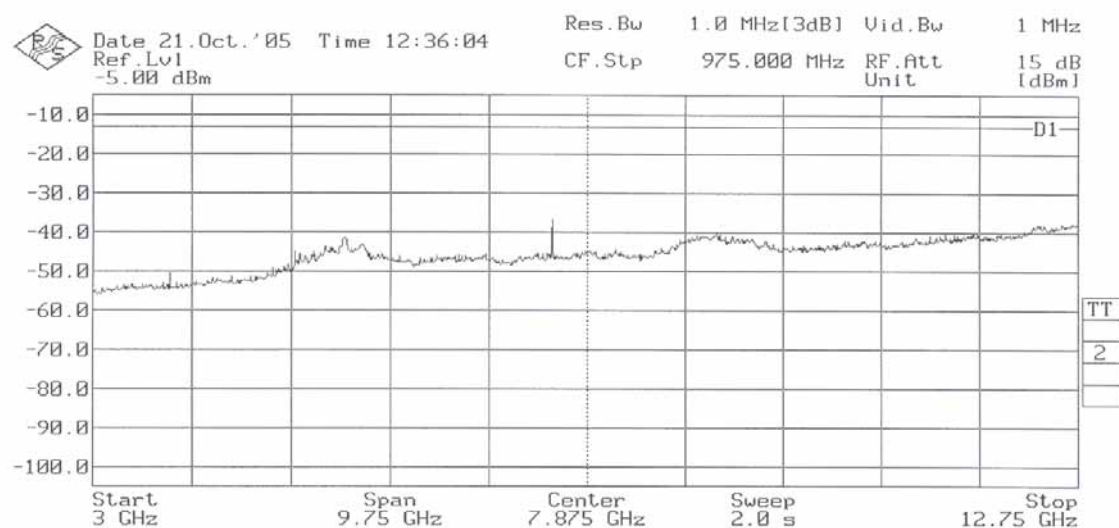
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FREQUENCY RANGE 3 GHz to 12.75 GHz.

CHANNEL: LOWEST (1850.2 MHz)



CHANNEL: MIDDLE (1880.2 MHz)



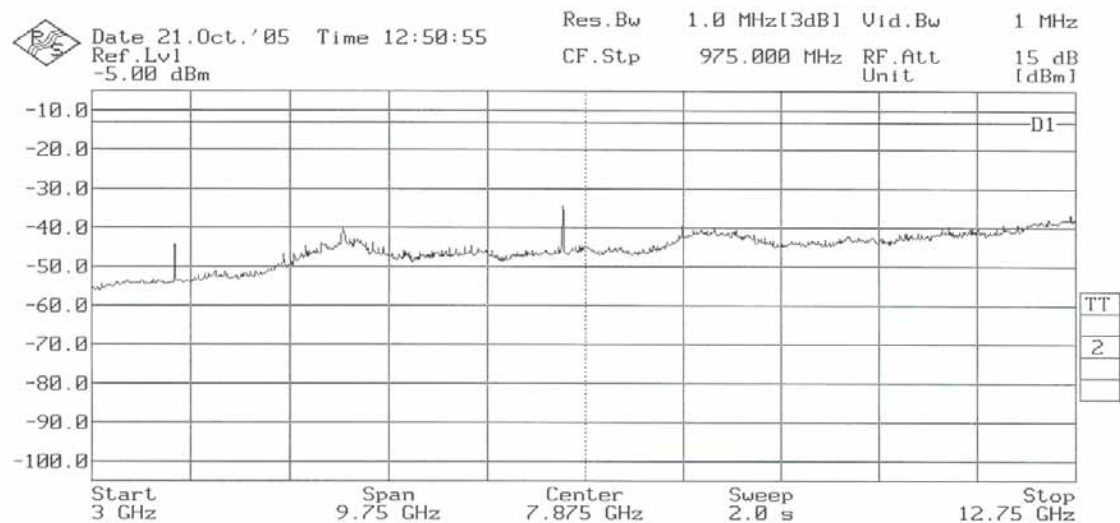
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CHANNEL: HIGHEST (1909.8 MHz)



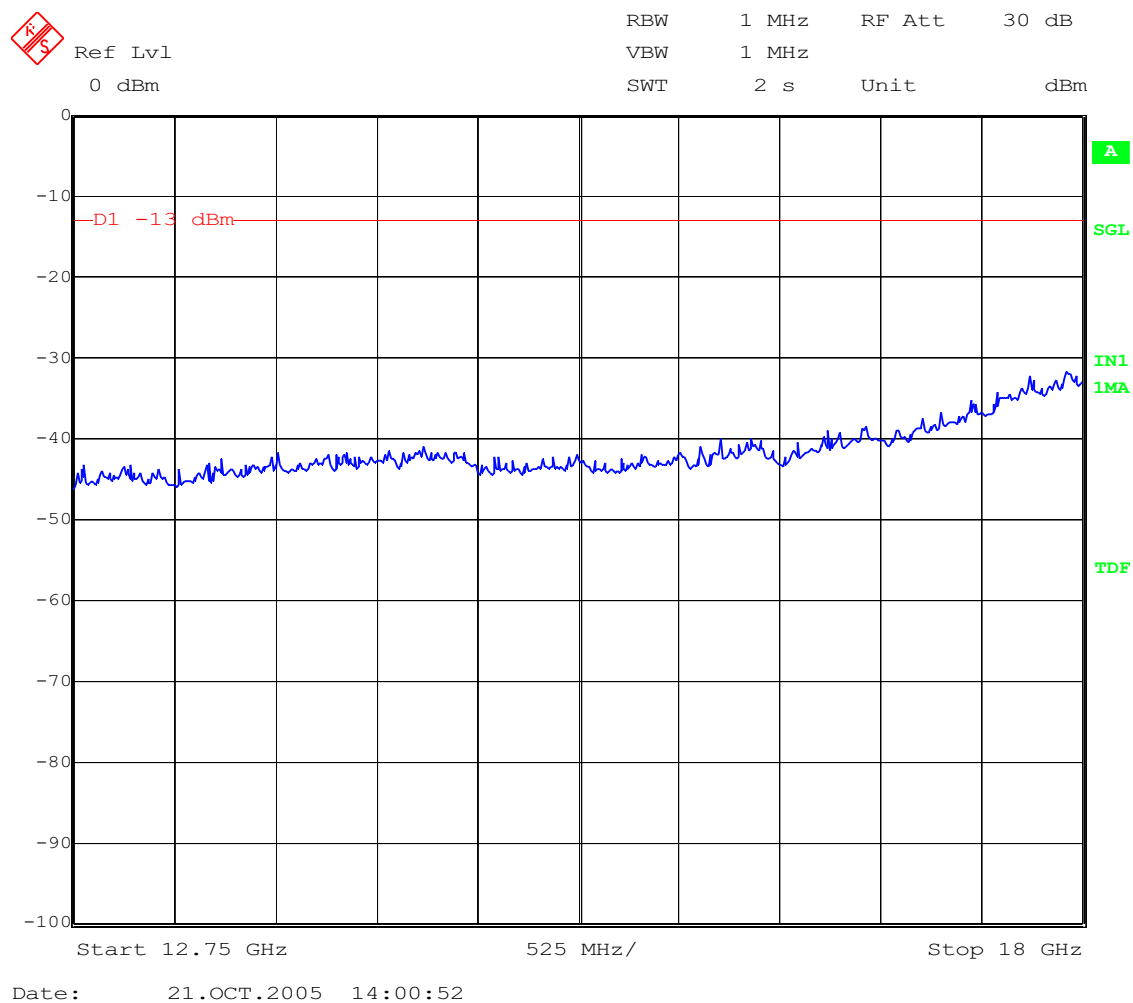
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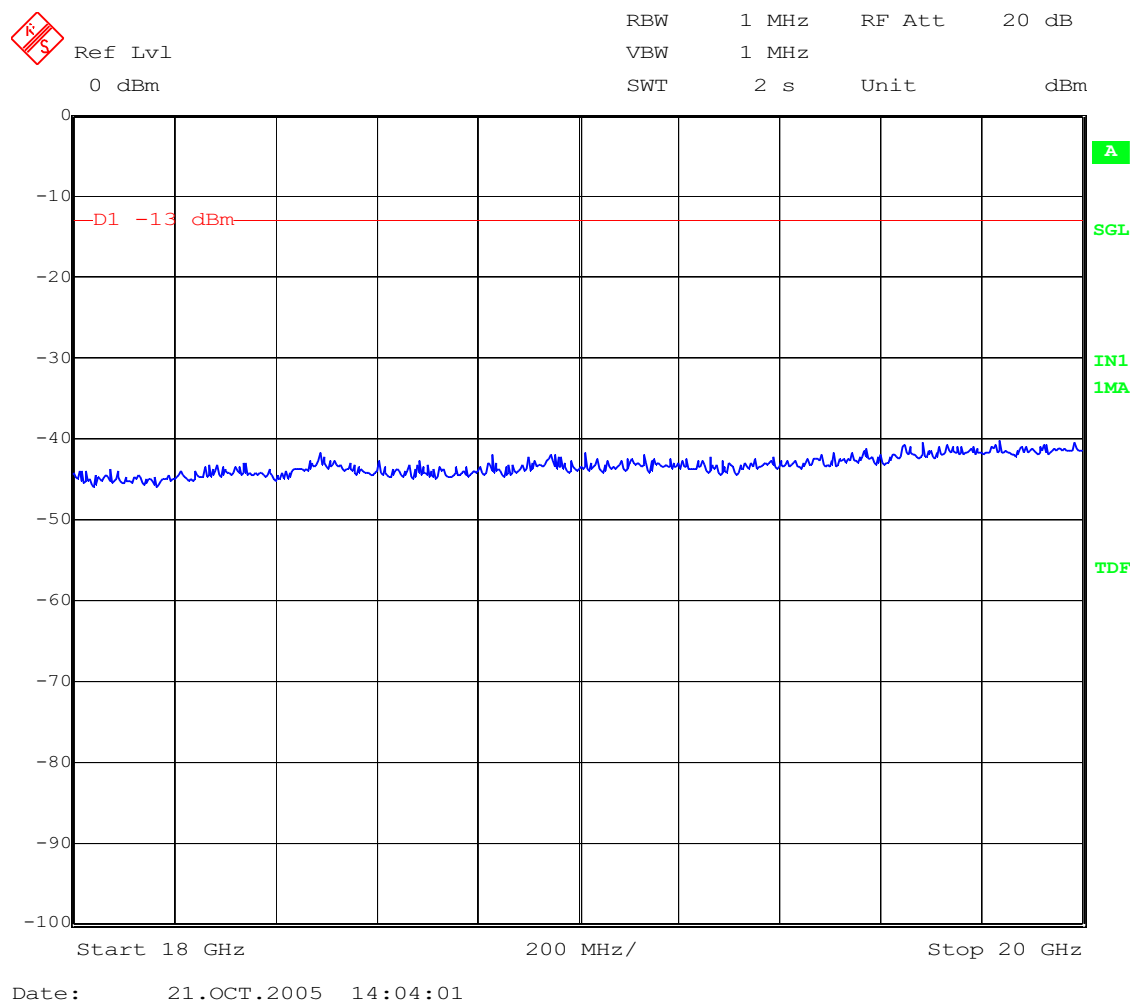
FREQUENCY RANGE 12.75 GHz TO 18 GHz.



(This plot is valid for all three channels).

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FREQUENCY RANGE 18 GHz TO 20 GHz.



(This plot is valid for all three channels).

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ANNEX C **MEASURING RESULTS FOR** **ELECTROMAGNETIC EMISSION**

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For samples under test, named S/01 and S/02, and that were formed by the elements described in the clause “Identification of the tested item/items” of this test report.

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* * *

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1. - CONTINUOUS CONDUCTED EMISSION, POWER LEADS ON THE SAMPLE S/02

LIMITS OF INTERFERENCE

The applied limit for continuous conducted emissions in power leads, according with the requirements of FCC Rules and Regulations 47 CFR Part 15, Subpart B in the frequency range 0,15 to 30 MHz, for Class B equipment was:

Frequency range (MHz)	Limit (dB μ V)	
	Quasi-peak	Average
0,15 to 0,5	66-56	56-46
0,5 to 5	56	46
5 to 30	60	50

TEST METHOD

According to Part 15, Subpart B of FCC Rules.

OPERATING MODES OF EUT

Different tested operating modes (OM)

- OM#03: EUT ON. IDLE mode (1900 MHz).
- OM#04: EUT ON. IDLE mode (850 MHz).

TEST RESULTS

CCmmnnxx: CC, Conduction condition°; mm: sample number; nn: operation mode; xx: wire.

- OM#03.

CDmmnnxx	Description	Result
CC02030N	Interference voltage on Neutral wire	PASS
CC0203L1	Interference voltage on phase wire	PASS

- OM#04.

CDmmnnxx	Description	Result
CC02040N	Interference voltage on Neutral wire	PASS
CC0204L1	Interference voltage on phase wire	PASS

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2. - CONTINUOUS CONDUCTED EMISSION, POWER LEADS ON THE SAMPLE S/02

LIMITS OF INTERFERENCE

The applied limit for continuous conducted emissions in power leads, according with the requirements of FCC Rules and Regulations 47 CFR Part 15, Subpart C in the frequency range 0,15 to 30 MHz, for Class B equipment was:

Frequency range (MHz)	Limit (dB μ V)	
	Quasi-peak	Average
0,15 to 0,5	66-56	56-46
0,5 to 5	56	46
5 to 30	60	50

TEST METHOD

According to Part 15, Subpart C of FCC Rules.

OPERATING MODES OF EUT

Different tested operating modes (OM)

- OM#05: EUT ON. TCH mode (1900 MHz).
- OM#06: EUT ON. TCH mode (850 MHz).

TEST RESULTS

CCmmnnxx: CC, Conduction condition^o; mm: sample number; nn: operation mode; xx: wire.

- OM#05.

CDmmnnxx	Description	Result
CC02050N	Interference voltage on Neutral wire	PASS
CC0205L1	Interference voltage on phase wire	PASS

- OM#06.

CDmmnnxx	Description	Result
CC02060N	Interference voltage on Neutral wire	PASS
CC0206L1	Interference voltage on phase wire	PASS

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3. - RADIATED EMISSION, ELECTROMAGNETIC FIELD ON THE SAMPLE S/01

LIMITS OF INTERFERENCE

The applied limit for radiated emissions, 3 m distance below 1 GHz and 1 m above 1 GHz, according with the requirements of FCC Rules and Regulations 47 CFR Part 15, Subpart B in the frequency range 30 MHz to 2 GHz, for Class B equipment, which is a transmitter in a band below 500 MHz, was:

Frequency range (MHz)	Limit for 3 m (μV/m)	Limit for 3 m (dBμV/m)
30 to 88	100	40
88 to 216	150	43,52
216 to 960	200	46,02
Above 960	500	53,98

TEST METHOD

According to Part 15, Subpart B of FCC Rules.

OPERATING MODES OF EUT

Different tested operating modes (OM)

- OM#03: EUT ON. IDLE mode (1900 MHz).
- OM#04: EUT ON. IDLE mode (850 MHz).

TEST RESULTS

CRmmnn: CR, Radiated Condition; mm: sample number; nn: operation mode.

- OM#03.

CRmmnn	Description	Result
CR0103	[30 MHz - 1000 MHz]	PASS
CR0103	[1 GHz – 12,5 GHz]	PASS

- OM#04.

CRmmnn	Description	Result
CR0104	[30 MHz - 1000 MHz]	PASS
CR0104	[1 GHz – 12,5 GHz]	PASS

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4. - GRAPH RESULTS

See next pages.

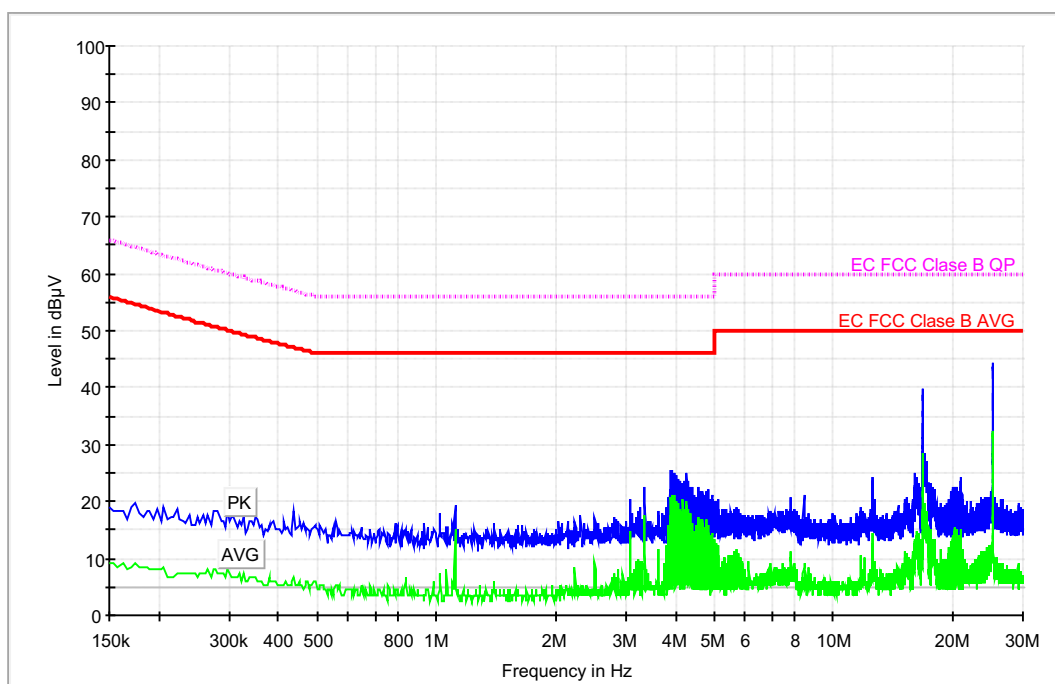
Continuous conducted emission: CC02030N (Peak and average)

EMC32 Report

Test Information

Proyecto: 22345iem.001
 Empresa: TELIT COMMUNICATIONS
 Muestra: M/02
 Modo operacion: MO#03
 Fecha: 2005-10-06 13:07
 Setup: EMI conducted
 Mode: EUT ON. Idle 1900MHz. Neutral noise.

EC FCC Clase B ESIB26 CC



Acceptance Analysis

Frequency (MHz)	MaxPeak-ClearWrite (dBµV)	Average-ClearWrite (dBµV)
25.182000	44.5	31.9

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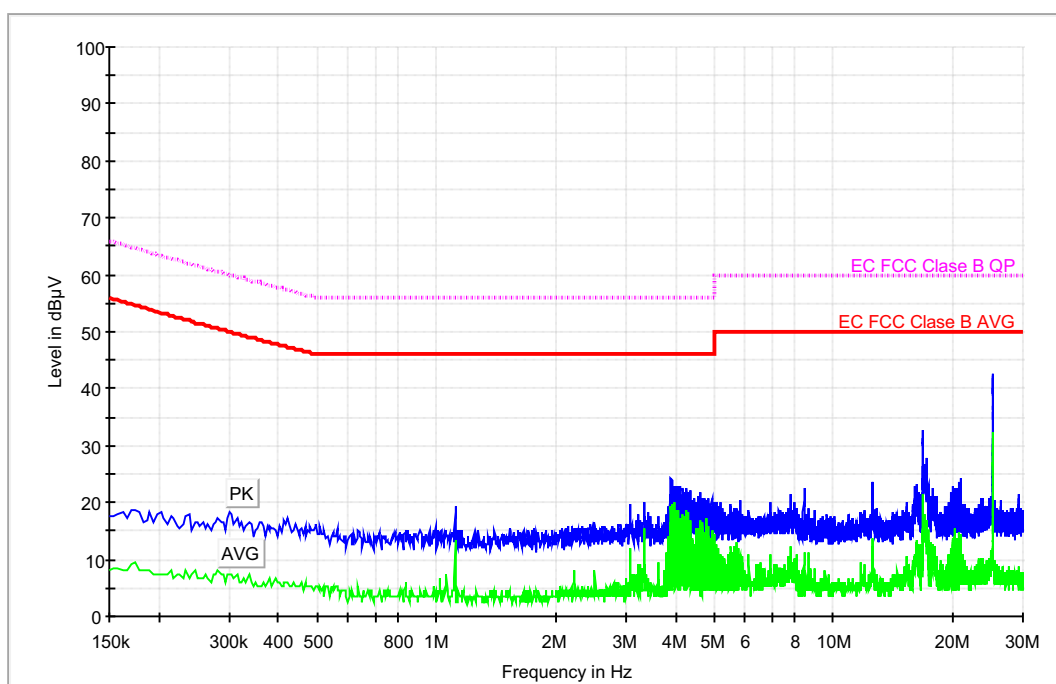
Continuous conducted emission: CC0203L1 (Peak and average)

EMC32 Report

Test Information

Proyecto: 22345iem.001
 Empresa: TELIT COMMUNICATIONS
 Muestra: M/02
 Modo operacion: MO#03
 Fecha: 2005-10-06 13:02
 Setup: EMI conducted
 Mode: EUT ON. Idle 1900MHz. Phase noise.

EC FCC Clase B ESIB26 CC



Acceptance Analysis

Frequency (MHz)	MaxPeak-ClearWrite (dBµV)	Average-ClearWrite (dBµV)
25.194000	42.5	32.4

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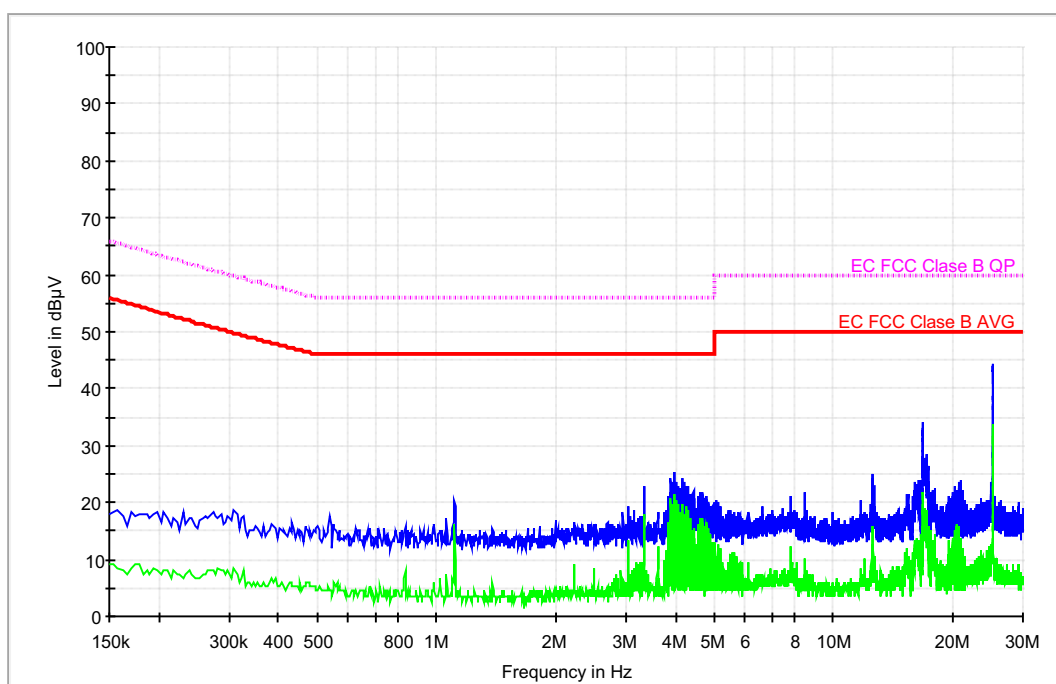
Continuous conducted emission: CC02040N (Peak and average)

EMC32 Report

Test Information

Proyecto: 22345iem.001
 Empresa: TELIT COMMUNICATIONS
 Muestra: M/02
 Modo operacion: MO#04
 Fecha: 2005-10-06 12:43
 Setup: EMI conducted
 Mode: EUT ON. Idle 850MHz. Neutral noise.

EC FCC Clase B ESIB26 CC



Acceptance Analysis

Frequency (MHz)	MaxPeak-ClearWrite (dBµV)	Average-ClearWrite (dBµV)
25.170000	44.4	26.5

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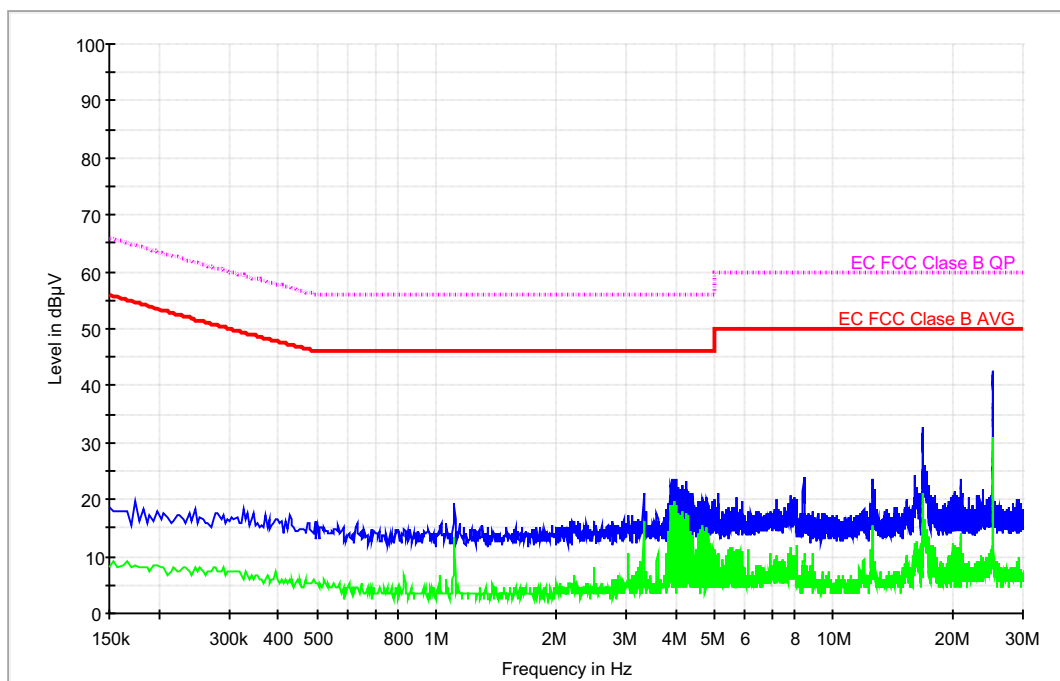
Continuous conducted emission: CC0204L1 (Peak and average)

EMC32 Report

Test Information

Proyecto: 22345iem.001
 Empresa: TELIT COMMUNICATIONS
 Muestra: M/02
 Modo operacion: MO#04
 Fecha: 2005-10-06 12:39
 Setup: EMI conducted
 Mode: EUT ON. Idle 850MHz. Phase noise.

EC FCC Clase B ESIB26 CC



Acceptance Analysis

Frequency (MHz)	MaxPeak-ClearWrite (dBµV)	Average-ClearWrite (dBµV)
25.162000	42.5	24.3

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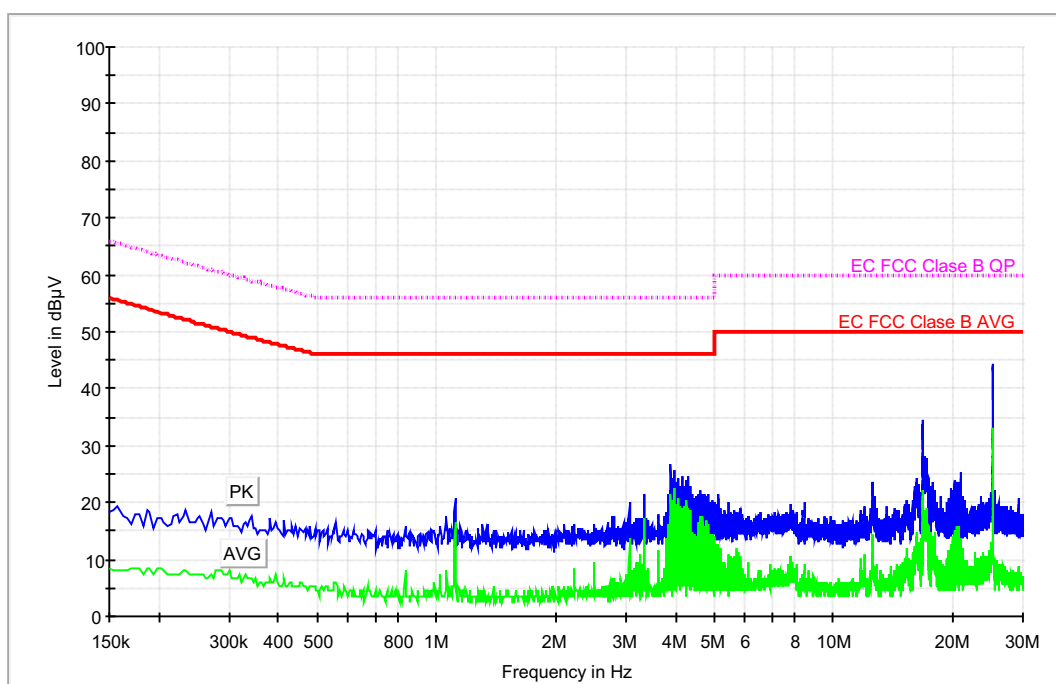
Continuous conducted emission: CC02050N (Peak and average)

EMC32 Report

Test Information

Proyecto: 22345iem.001
 Empresa: TELIT COMMUNICATIONS
 Muestra: M/02
 Modo operacion: MO#05
 Fecha: 2005-10-06 12:52
 Setup: EMI conducted
 Mode: EUT ON. TCH 1900MHz. Neutral noise.

EC FCC Clase B ESIB26 CC



Acceptance Analysis

Frequency (MHz)	MaxPeak-ClearWrite (dBµV)	Average-ClearWrite (dBµV)
25.194000	44.3	32.2

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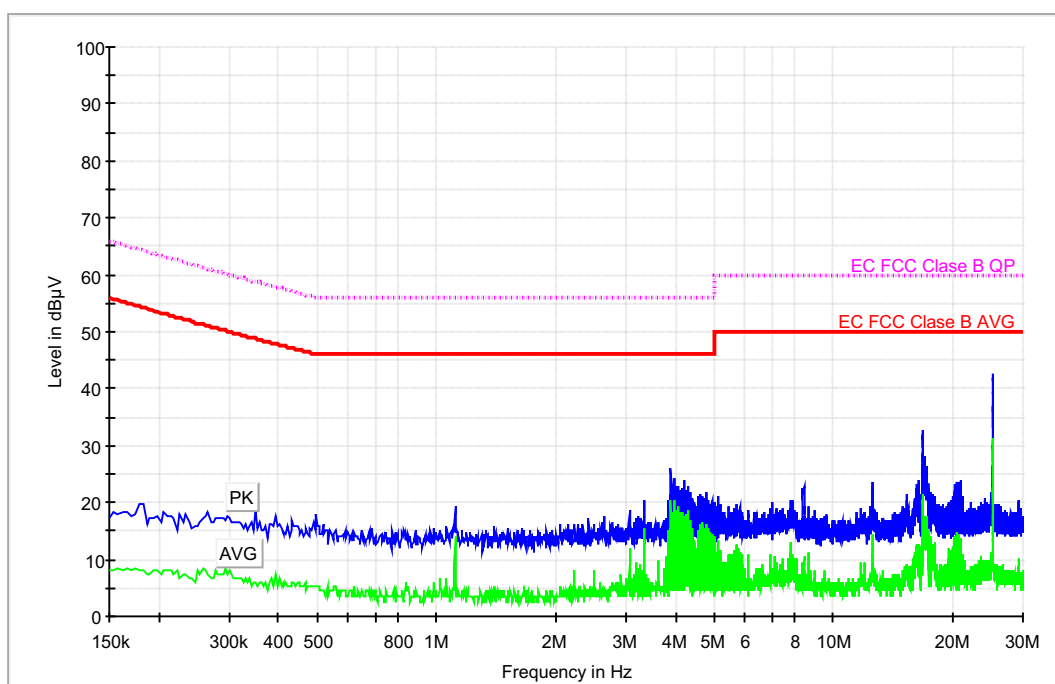
Continuous conducted emission: CC0205L1 (Peak and average)

EMC32 Report

Test Information

Proyecto: 22345iem.001
 Empresa: TELIT COMMUNICATIONS
 Muestra: M/02
 Modo operacion: MO#05
 Fecha: 2005-10-06 12:55
 Setup: EMI conducted
 Mode: EUT ON. TCH 1900MHz. Phase noise.

EC FCC Clase B ESIB26 CC



Acceptance Analysis

Frequency (MHz)	MaxPeak-ClearWrite (dBµV)	Average-ClearWrite (dBµV)
25.182000	42.5	29.4

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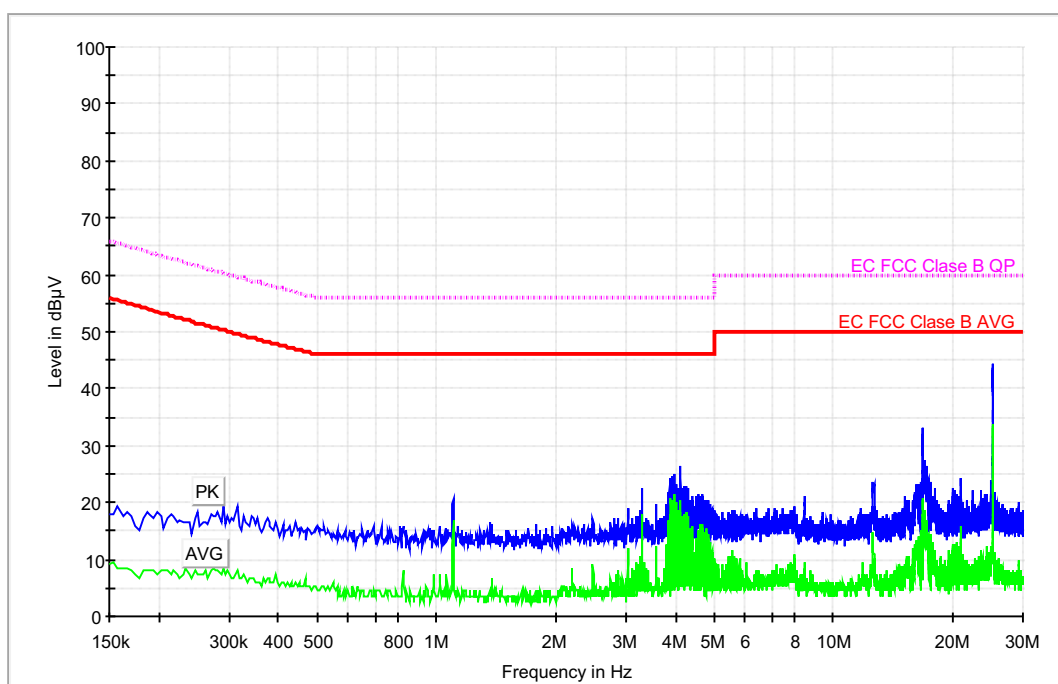
Continuous conducted emission: CC02060N (Peak and average)

EMC32 Report

Test Information

Proyecto: 22345iem.001
 Empresa: TELIT COMMUNICATIONS
 Muestra: M/02
 Modo operacion: MO#06
 Fecha: 2005-10-06 12:43
 Setup: EMI conducted
 Mode: EUT ON. TCH 850MHz. Neutral noise.

EC FCC Clase B ESIB26 CC



Acceptance Analysis

Frequency (MHz)	MaxPeak-ClearWrite (dBµV)	Average-ClearWrite (dBµV)
25.202000	44.5	33.5

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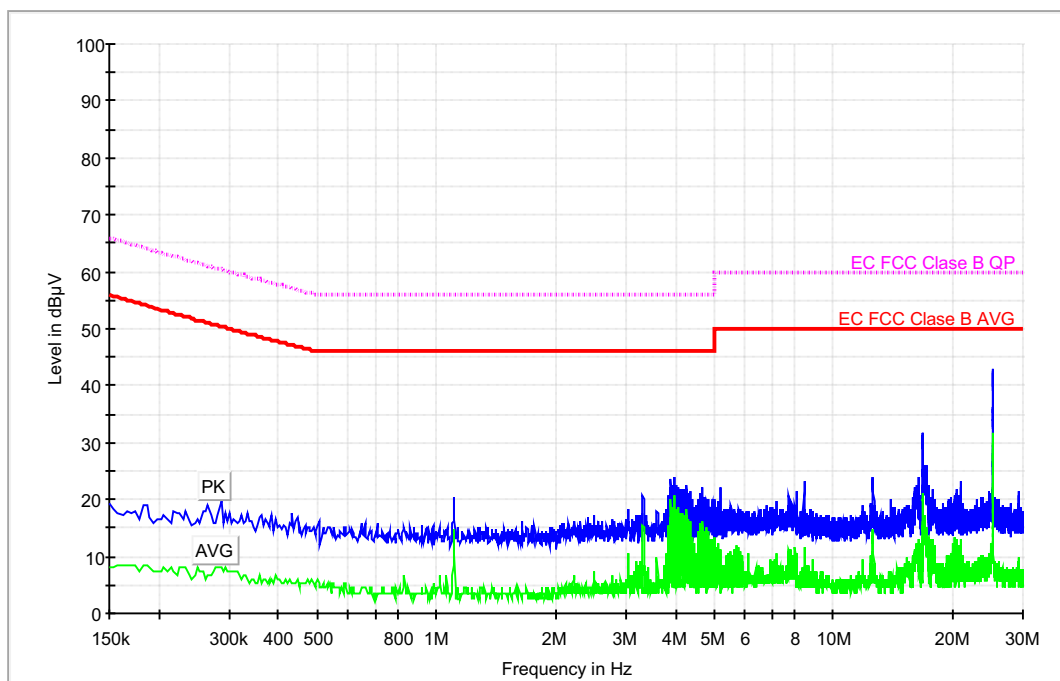
Continuous conducted emission: CC0206L1 (Peak and average)

EMC32 Report

Test Information

Proyecto: 22345iem.001
 Empresa: TELIT COMMUNICATIONS
 Muestra: M/02
 Modo operacion: MO#06
 Fecha: 2005-10-06 12:44
 Setup: EMI conducted
 Mode: EUT ON. TCH 850MHz. Phase noise.

EC FCC Clase B ESIB26 CC



Acceptance Analysis

Frequency (MHz)	MaxPeak-ClearWrite (dBµV)	Average-ClearWrite (dBµV)
25.202000	42.8	31.5

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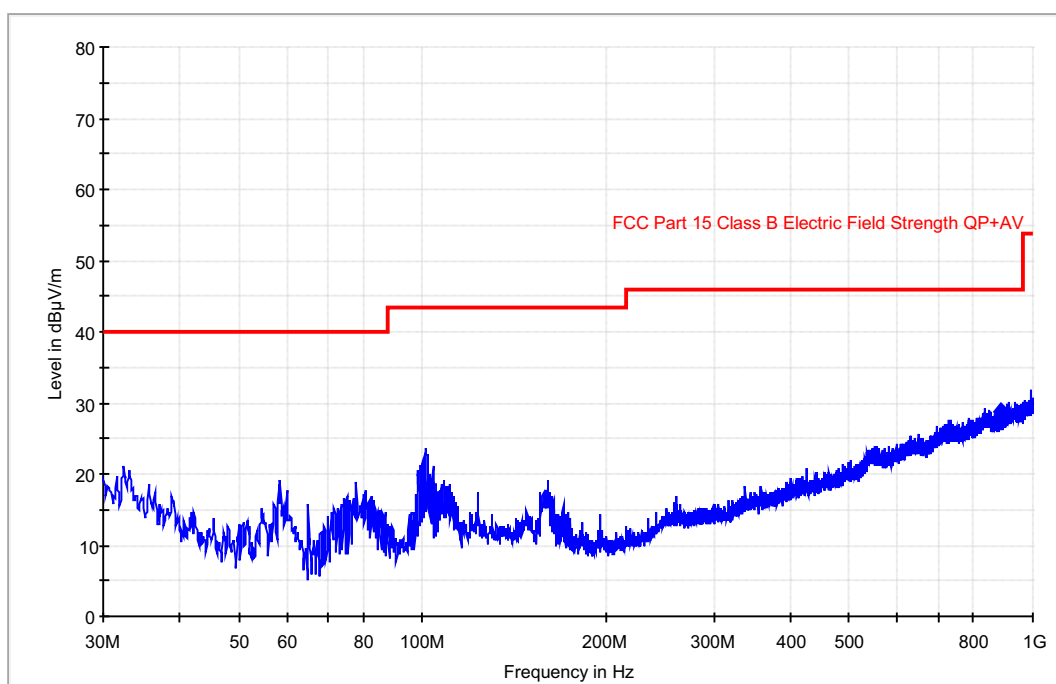
Radiated emission: CR0103 (30 MHz – 1000 MHz)

EMC32 Report

Test Information

Proyecto:	22345iem.001
Empresa:	TELIT COMMUNICATIONS
Muestra:	M/01
Modo operacion:	MO#03
Fecha:	2005-09-02 14:33
Setup:	EMI radiated
Mode:	EUT ON. Idle 1900MHz mode.

FCC clase B



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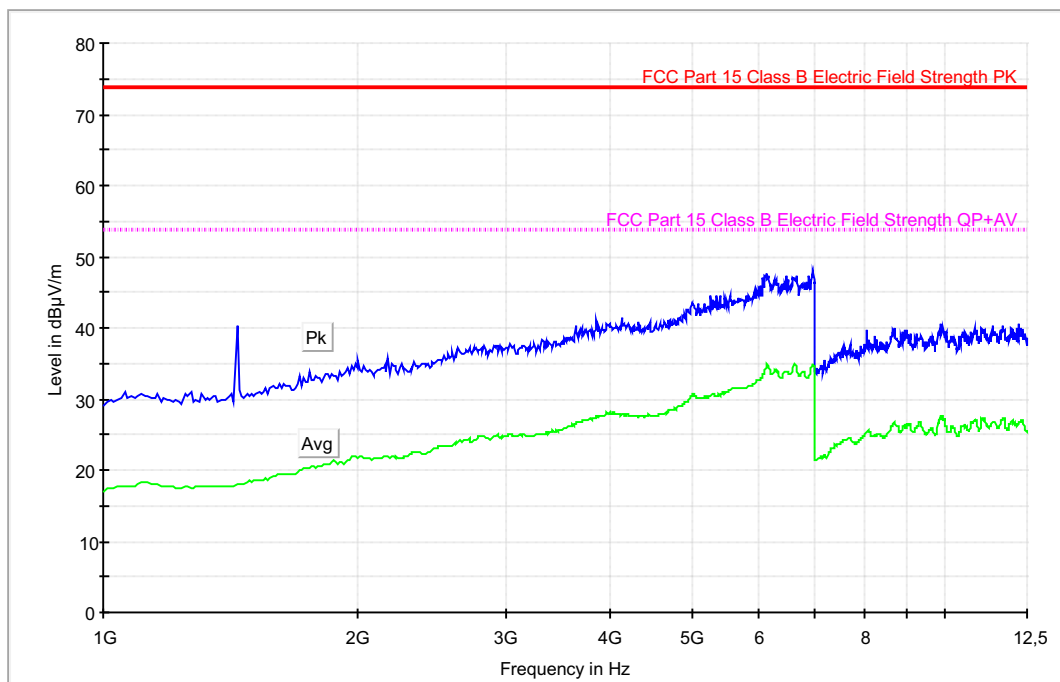
Radiated emission: CR0103 (1 GHz – 12,5 GHz). Horizontal polarization

EMC32 Report

Test Information

Proyecto: 22345iem.001
 Empresa: TELIT COMUNICATIONS
 Muestra: M/01
 Modo operacion: MO#03
 Fecha: 2005-09-07 14:58
 Setup: EMI radiated
 Mode: EUT ON. Idle 1900 MHz mode.
 Description: Horizontal Polarization.

FCC 1-12.5GHz



DataReduction Detector1

Frequency (MHz)	MaxPeak-ClearWrite (dBµV/m)	Average-ClearWrite (dBµV/m)
1440.000000	40.2	18.1
6130.000000	47.7	34.6
6970.000000	47.7	34.7
8070.000000	39.7	25.3
8700.000000	39.9	26.6
9890.000000	40.6	27.4
12240.000000	40.5	26.6

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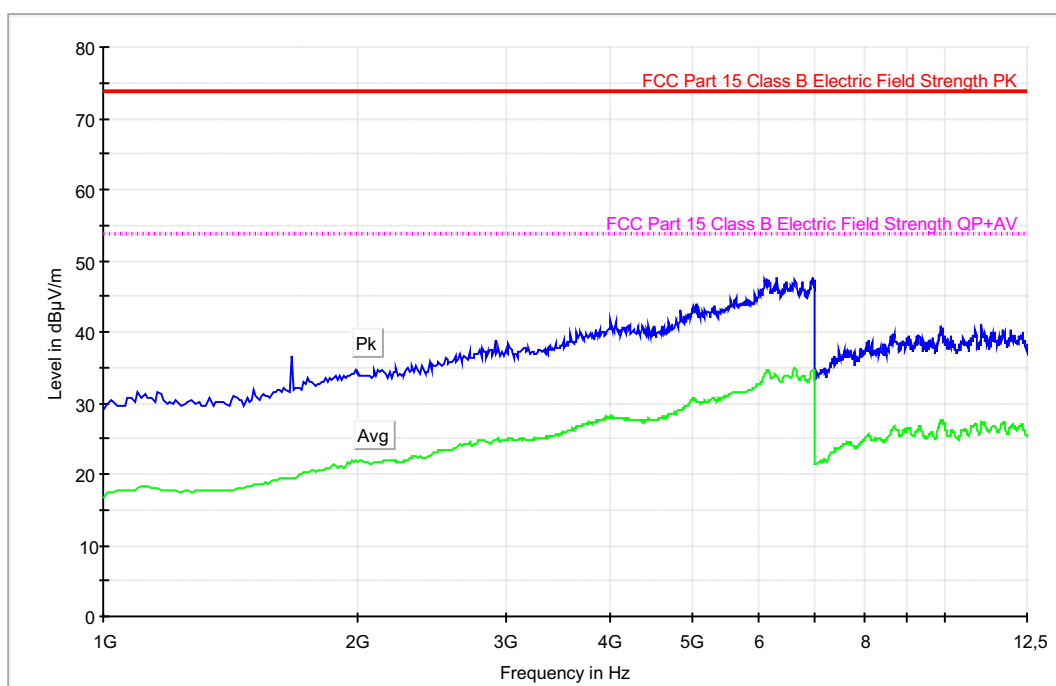
Radiated emission: CR0103 (1 GHz – 12,5 GHz) Vertical Polarization

EMC32 Report

Test Information

Proyecto: 22345iem.001
 Empresa: TELIT COMMUNICATIONS
 Muestra: M/01
 Modo operacion: MO#03
 Fecha: 2005-09-07 14:59
 Setup: EMI radiated
 Mode: EUT ON. Idle 1900 MHz mode.
 Description: Vertical Polarization.

FCC 1-12.5GHz



DataReduction Detector1

Frequency (MHz)	MaxPeak-ClearWrite (dBµV/m)	Average-ClearWrite (dBµV/m)
1670.000000	36.6	19.5
6310.000000	47.7	33.9
9890.000000	40.8	27.4
11050.000000	41.1	27.2

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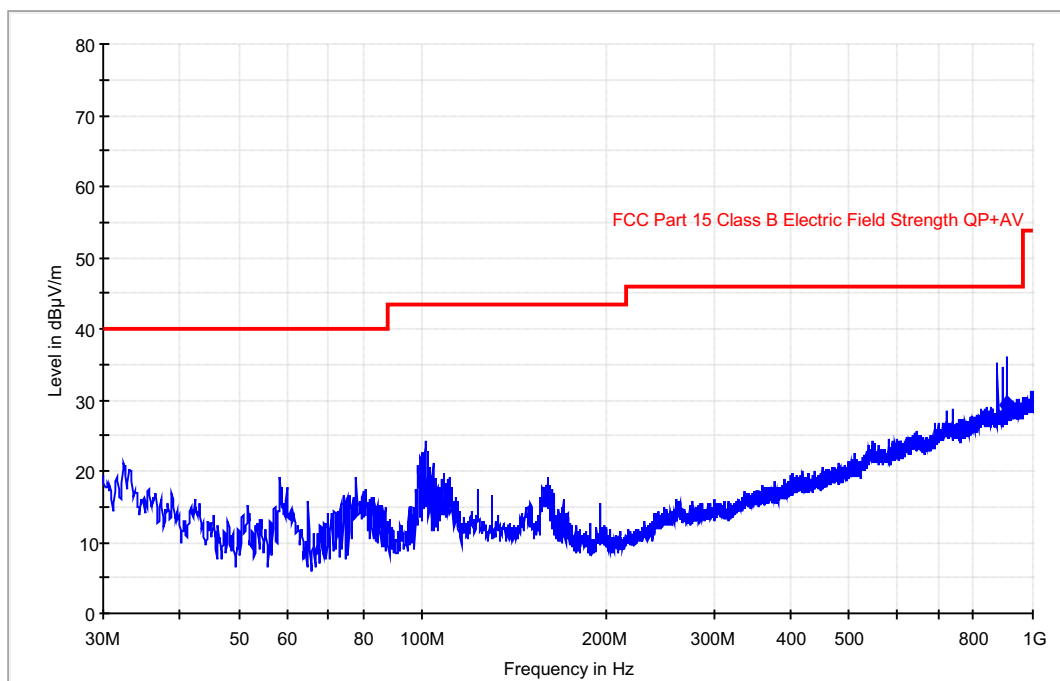
Radiated emission: CR0104 (30 MHz – 1000 MHz)

EMC32 Report

Test Information

Proyecto:	22345iem.001
Empresa:	TELIT COMMUNICATIONS
Muestra:	M/01
Modo operacion:	MO#04
Fecha:	2005-09-02 15:07
Setup:	EMI radiated
Mode:	EUT ON. Idle 850MHz mode.

FCC clase B



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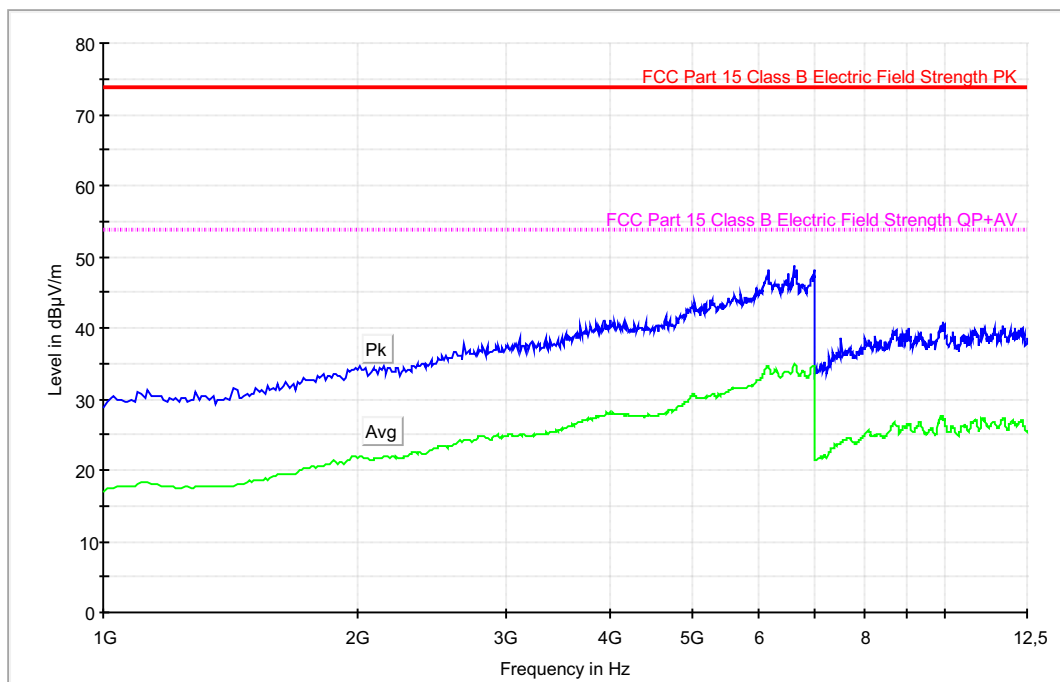
Radiated emission: CR0104 (1 GHz – 12,5 GHz). Horizontal polarization

EMC32 Report

Test Information

Proyecto:	22345iem.001
Empresa:	TELIT COMMUNICATIONS
Muestra:	M/01
Modo operacion:	MO#04
Fecha:	2005-09-07 14:59
Setup:	EMI radiated
Mode:	EUT ON. Idle 850 MHz mode.
Description	Horizontal Polarization.

FCC 1-12.5GHz



DataReduction Detector1

Frequency (MHz)	MaxPeak-ClearWrite (dBµV/m)	Average-ClearWrite (dBµV/m)
6610.000000	48.8	34.8

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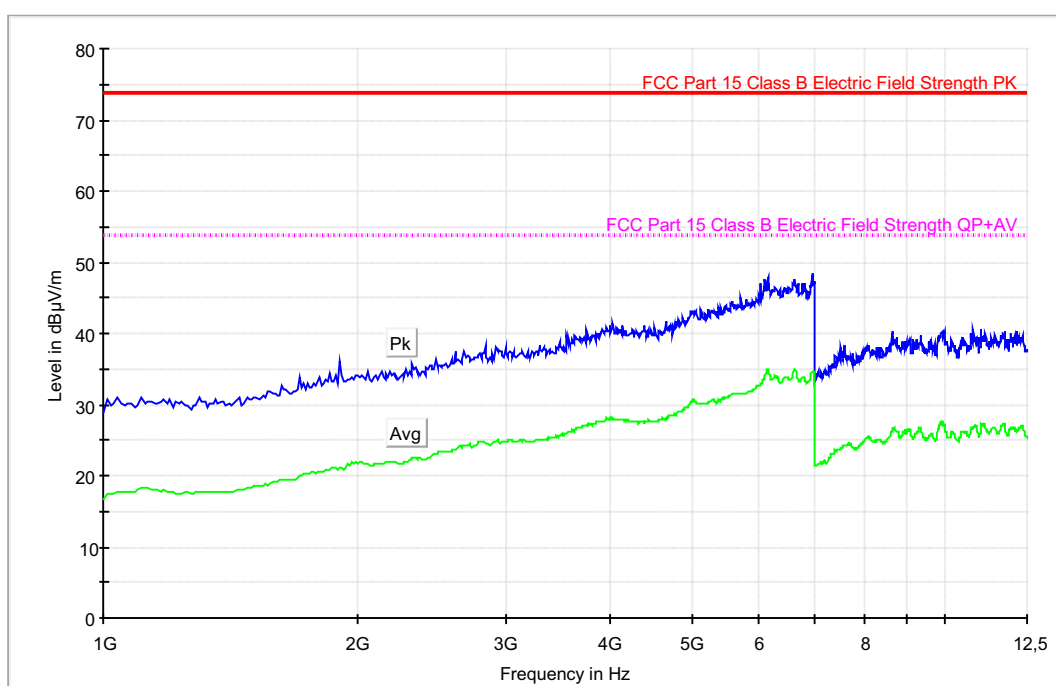
Radiated emission: CR0104 (1 GHz – 12,5 GHz) Vertical Polarization

EMC32 Report

Test Information

Proyecto:	22345iem.001
Empresa:	TELIT COMUNICATIONS
Muestra:	M/01
Modo operacion:	MO#04
Fecha:	2005-09-07 15:01
Setup:	EMI radiated
Mode:	EUT ON. Idle 850 MHz mode.
Description	Vertical Polarization.

FCC 1-12.5GHz



DataReduction Detector1

Frequency (MHz)	MaxPeak-ClearWrite (dBµV/m)	Average-ClearWrite (dBµV/m)
6960.000000	48.4	34.8
11040.000000	40.6	27.0

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ANNEX D

PHOTOGRAPHS **(Number of photographs: 5)**

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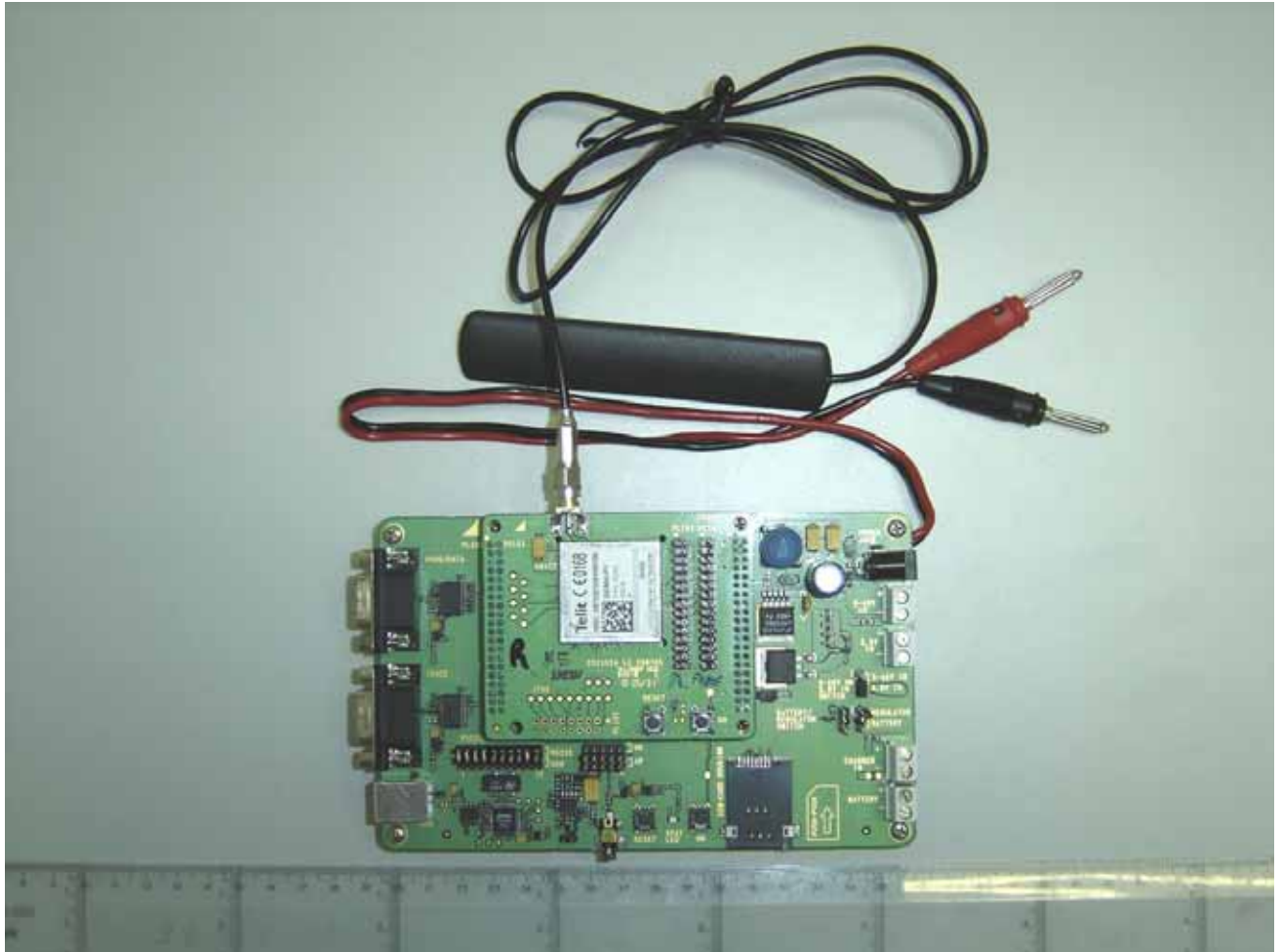
Date: 2005-11-29

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Annex D

1. Equipment with evaluation board.



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2. Equipment with removed evaluation board



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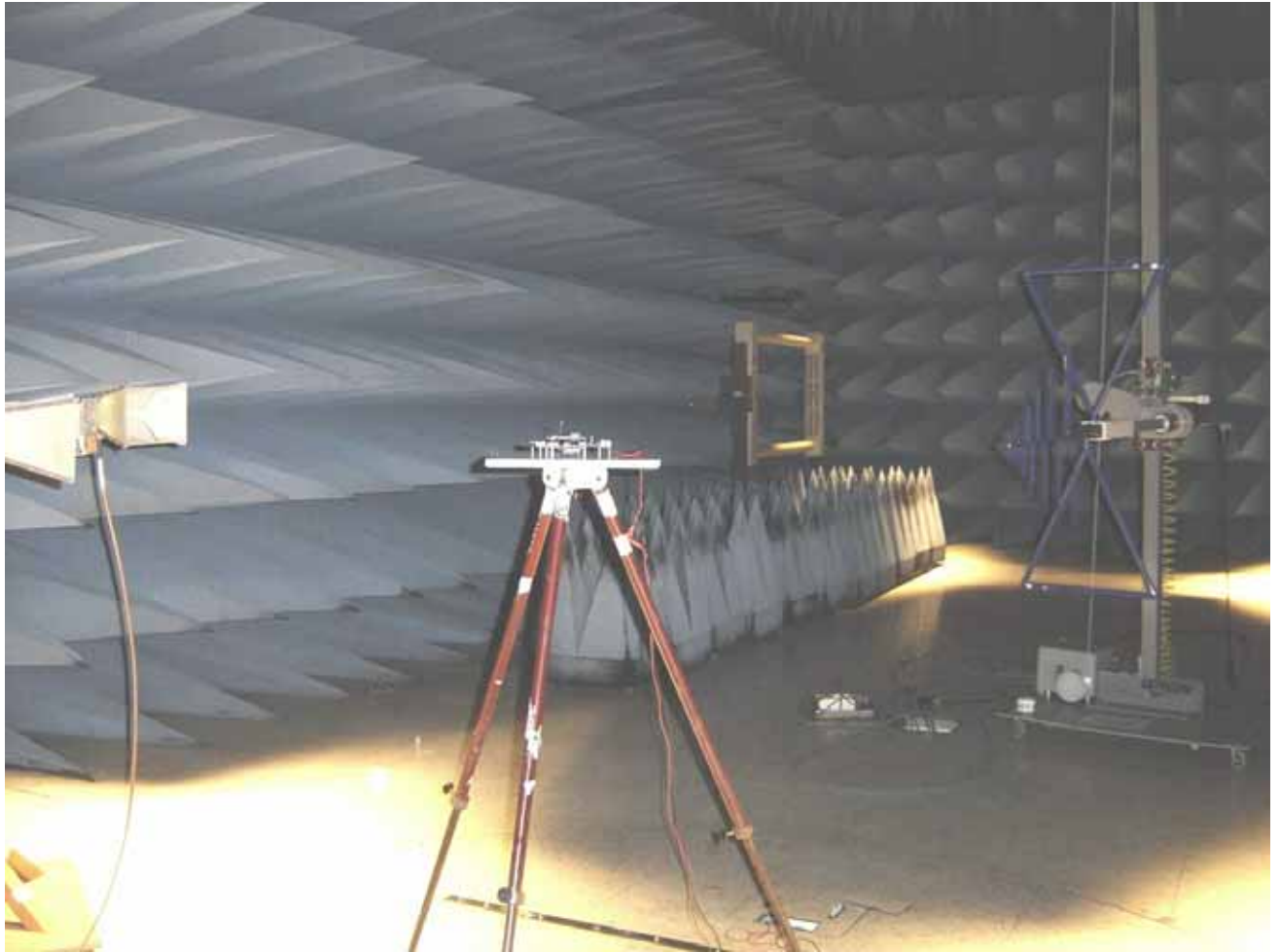
Date: 2005-11-29

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Annex D

3. General test set-up for radiated measurements.



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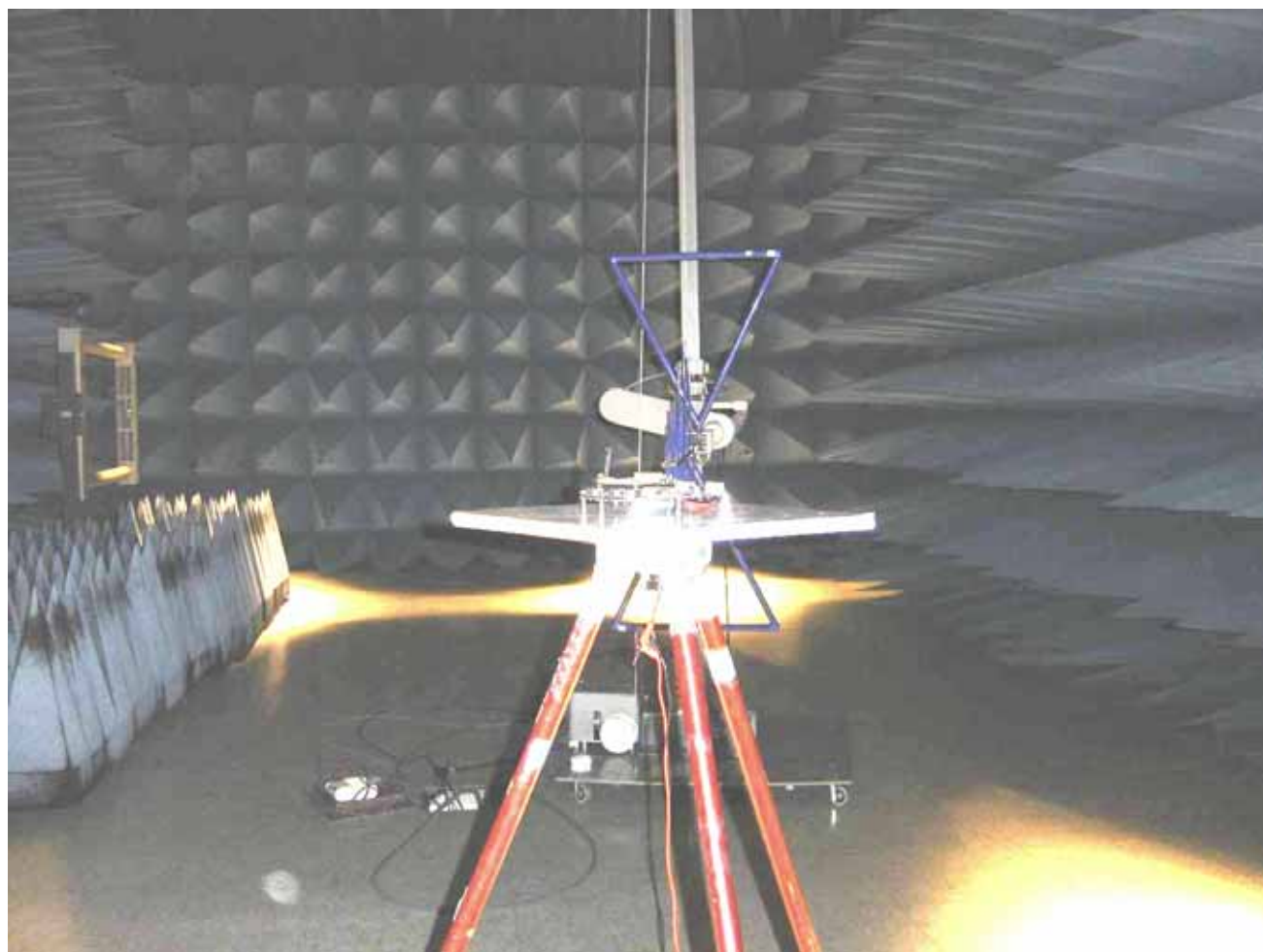
Date: 2005-11-29

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4. Test set-up for radiated measurements below 1 GHz.



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5. Test set-up for radiated measurements above 1 GHz.

