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REGISTRATION
NUMBER: 905266

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REGISTRATION
NUMBER: IC 4621

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TEST REPORT


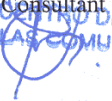
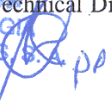
Report No.: 22656RET

TEST NAME: FCC PART 22 & PART 24

Product : 850/1900 DUAL BAND GSM PHONES
Trade Mark : MOVISTAR
Model/type Ref. : TSM1
TSM2
Manufacturer : VITELCOM MOBILE TECHNOLOGY, S.A.
Requested by : VITELCOM MOBILE TECHNOLOGY, S.A.
Other identification of the product : Serial numbers:
355409003707589
356031006603588
355409003708009
Standard(s) : USA FCC Part 22 & Part 24

This test report includes 5 annexes and therefore the total number of pages is 81.

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Date: 2005-08-02	Test operator A. Llamas 	Revised by: Date: 02.08.05 J.C. Soler Consultant 	Approved by: Date: 02.08.05 A. Rojas Technical Director 	Page: 1 of 9
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ANNEXES

ANNEX A. TEST RESULTS FOR FCC PART 22. MODEL TSM2

ANNEX B. TEST RESULTS FOR FCC PART 24. MODEL TSM2

ANNEX C. TEST RESULTS FOR FCC PART 22. MODEL TSM1

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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

Measurements for PCS 850 and PCS 1900 devices according to FCC parts 22 and 24:

-Full testing for model TSM2.

-Radiated emissions testing for model TSM1 for compliance check for this model which incorporates the same radio part as model TSM2 but different type of display and location and shape of the keys.

3.2 REQUIREMENTS AND METHOD

The test has been carried out according to FCC parts 22 and 24.

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 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.

4. IDENTIFICATION DATA SUPPLIED BY THE APPLICANT

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

4.1 APPLICANT

Name or Company: VITELCOM MOBILE TECHNOLOGY, S.A.

V.A.T.: A92253137

Address: Avda. Juan López Peñalver, 7, P.T.A.

City: Campanillas (MALAGA)

Postal code: 29590

Country: SPAIN

Telephone: +34 952028686

Fax: +34 952367590

4.2 REPRESENTATIVE

Name: Jose Luis Córdoba (R&D HW Engineering Director)

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: 850/1900 DUAL BAND GSM PHONES

Trade mark: MOVISTAR

Model: TSM1 , TSM2

FCC ID (TSM1): THKSP102

FCC ID (TSM2): TKH-A109-TSM2

Manufacturer: VITELCOM MOBILE TECHNOLOGY, S.A.

Country of manufacture: SPAIN

Manufacture site: Avda. Juan López Peñalver, 7, P.T.A. Campanillas (MALAGA) SPAIN

Description: The TSM1 is a 850/1900 MHz dual band GSM mobile phone with 128x128 pixels B&W display with SMS message support.

The TSM2 is a 850/1900 MHz dual band GSM mobile phone with 128x128 pixels 4 K colour display with SMS message support.

The only differences between TSM1 and TSM2 mobile phones are the display (TSM2 includes a colour display) and the location and shape of the keys.

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>
22656/01	Dual band GSM 850/1900 mobile phone with integral antenna	TSM2	355409003707589	12/07/05

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>
22656/03	Dual band GSM/GPRS 850/1900 mobile phone with antenna connector	TSM2	355409003708009	12/07/05
22656/05	Dummy battery for external power supply	---	---	12/07/05

Sample M/03 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>
22656/02	Dual band GSM 850/1900 mobile phone with integral antenna	TSM1	356031006603588	12/07/05

1. Sample M/01 has undergone following test(s).
Radiated output power and Radiated emissions measurements indicated in annex A and B.
2. Sample M/02 has undergone 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 M/03 has undergone following test(s).
Radiated emissions measurements indicated in annex C and D.

5.2 PERIOD OF TESTING

The performed test started on 2005-07-13 and finished on 2005-07-14.

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. = 23 °C Max. = 23 °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 kΩ
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. = 22 °C Max. = 22 °C
Relative humidity	Min. = 48 % Max. = 48 %
Air pressure	Min. = 1020 mbar Max. = 1020 mbar
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
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

I. MODEL TSM2

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		

II. MODEL TSM1

FCC PART 22 PARAGRAPH	VERDICT			
	NA	P	F	NM
Clause 22.913: RF output power				NM ¹
Clause 22.355: Frequency stability				NM ¹
Clause 22.917: Spurious emissions at antenna terminals				NM ¹
Clause 22.917: Radiated emissions		P		

FCC PART 24 PARAGRAPH	VERDICT			
	NA	P	F	NM
Clause 24.232: RF output power				NM ¹
Clause 24.235: Frequency stability				NM ¹
Clause 24.238: Spurious emissions at antenna terminals				NM ¹
Clause 24.238: Radiated emissions		P		

1: see point 7: Remarks and comments

7. REMARKS AND COMMENTS

1. Test not performed (see point 3.1 “TEST REQUESTED”).

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”.

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ANNEX A
TEST RESULTS FOR FCC PART 22
MODEL TSM2

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Annex A

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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 rechargeable battery

Type of antenna = Integral antenna

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)	32.31	32.24	32.16
Maximum peak power (W)	1.70	1.67	1.64
Measurement uncertainty (dB)	± 1.5		

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

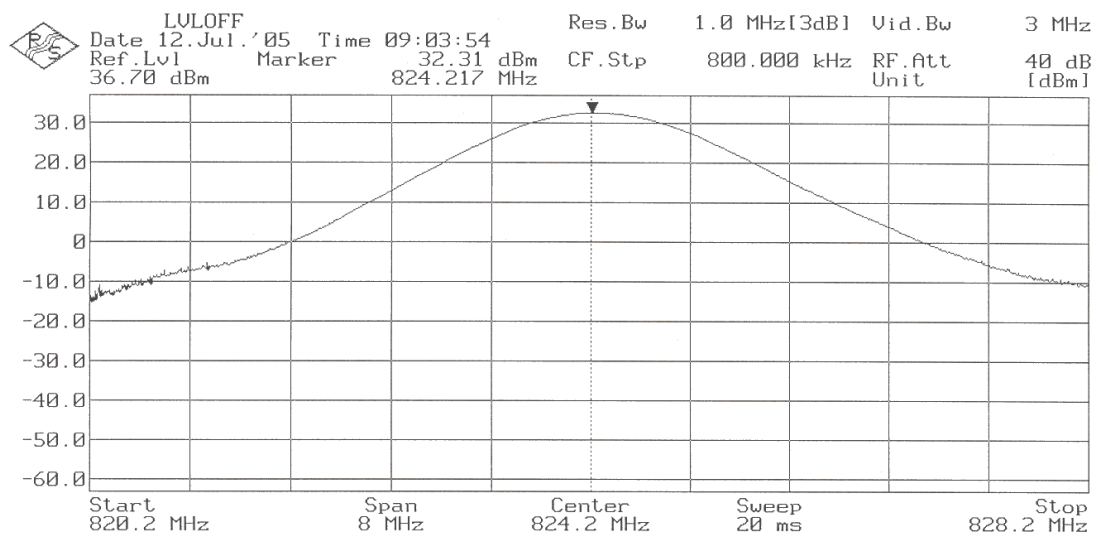
Channel	Lowest	Middle	Highest
Maximum peak power (dBm)	33.54	34.70	33.48
Maximum peak power (W)	2.26	2.95	2.23
Measurement uncertainty (dB)	± 3.8		

Verdict: PASS

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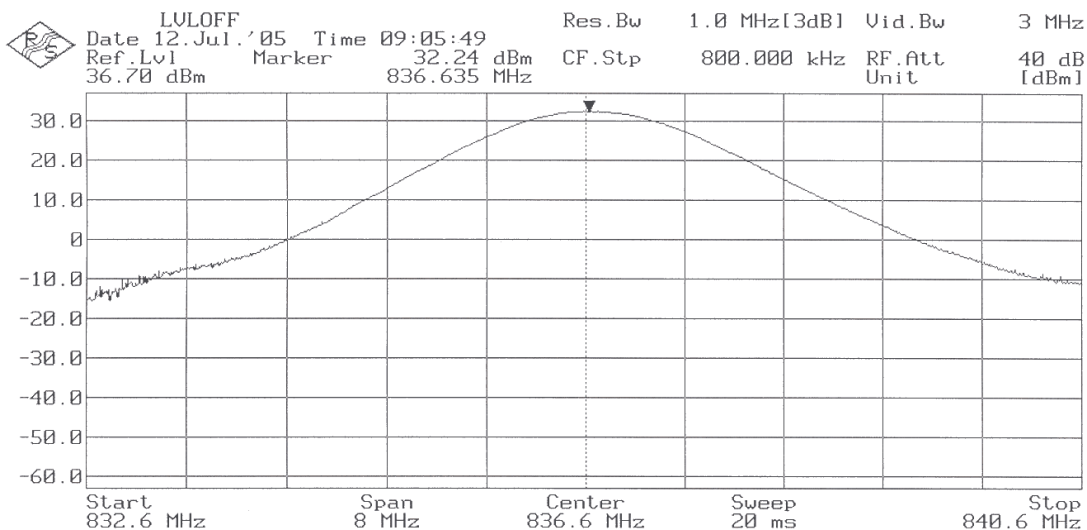
PEAK OUTPUT POWER (CONDUCTED).

Lowest Channel: 824.2 MHz.



PEAK OUTPUT POWER (CONDUCTED).

Middle Channel: 836.6 MHz.



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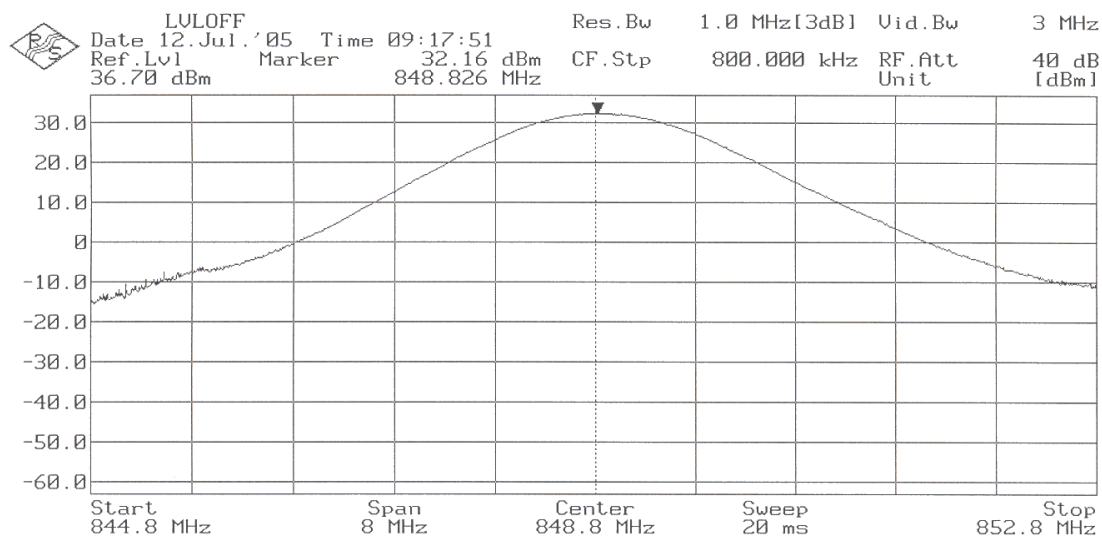
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PEAK OUTPUT POWER (CONDUCTED).

Highest Channel: 848.8 MHz.



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Annex A

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	-37	-0.0442	-0.00000442
+40	-41	-0.0490	-0.00000490
+30	-39	-0.0466	-0.00000466
+20	-22	-0.0263	-0.00000263
+10	-31	-0.0371	-0.00000371
0	-18	-0.0215	-0.00000215
-10	-14	-0.0167	-0.00000167
-20	-12	-0.0143	-0.00000143
-30	-11	-0.0131	-0.00000131

Frequency stability over voltage variations.

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)	Frequency Error (%)
Vmax	4.2	+33	+0.0394	+0.00000394
Vmin	3.4	+52	+0.0622	+0.00000622

Verdict: PASS

Occupied Bandwidth

SPECIFICATION

§2.1049

METHOD

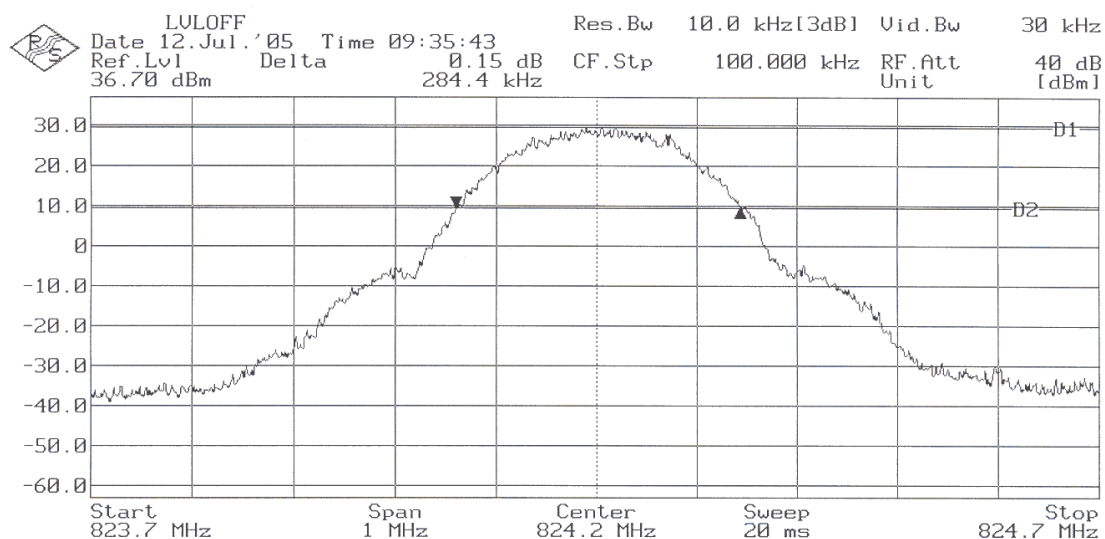
The EUT was configured to transmit a GMSK modulated carrier signal. An IF bandwidth of 10 kHz was used to determined the occupied bandwidth of the modulated emission.

RESULTS

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	284.4	282.2	281.1
Measurement uncertainty (Hz)	±11		

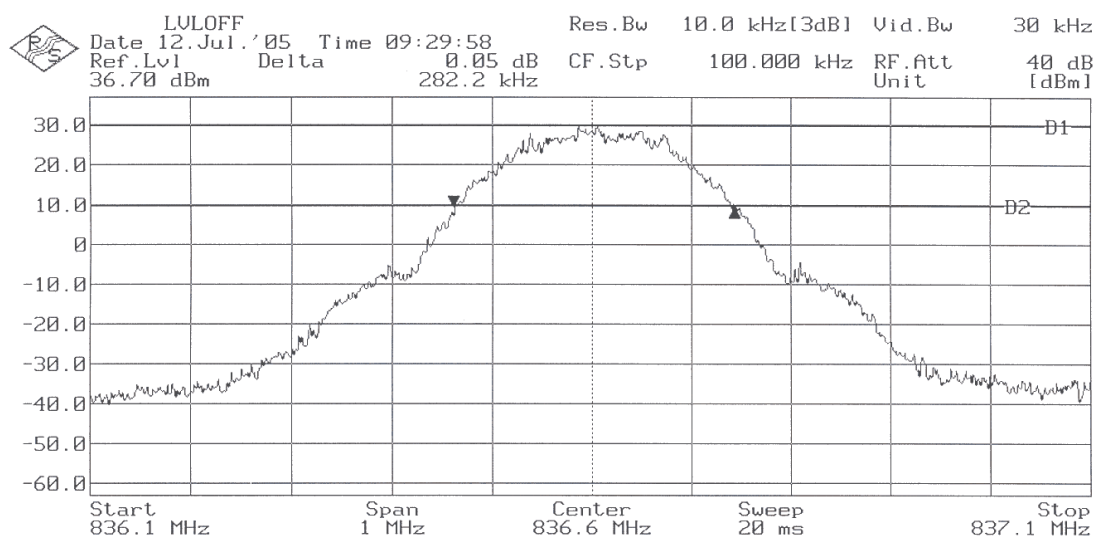
99% OCCUPIED BANDWIDTH

Lowest Channel: 824.2 MHz.



99% OCCUPIED BANDWIDTH

Middle Channel: 836.6 MHz.



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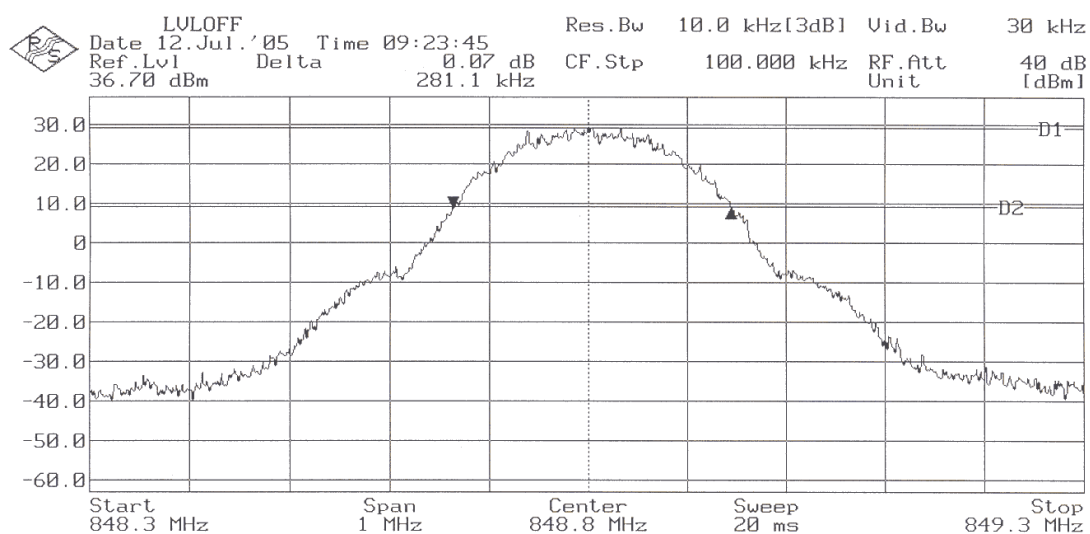
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99% OCCUPIED BANDWIDTH

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) = 32.30

Spurious frequency (MHz)	Level (dBm)	Attenuation below carrier (dBc)
1648.385	-28.82	61.12

2. CHANNEL: MIDDLE (836.6 MHz).

No spurious signals were found in all the range.

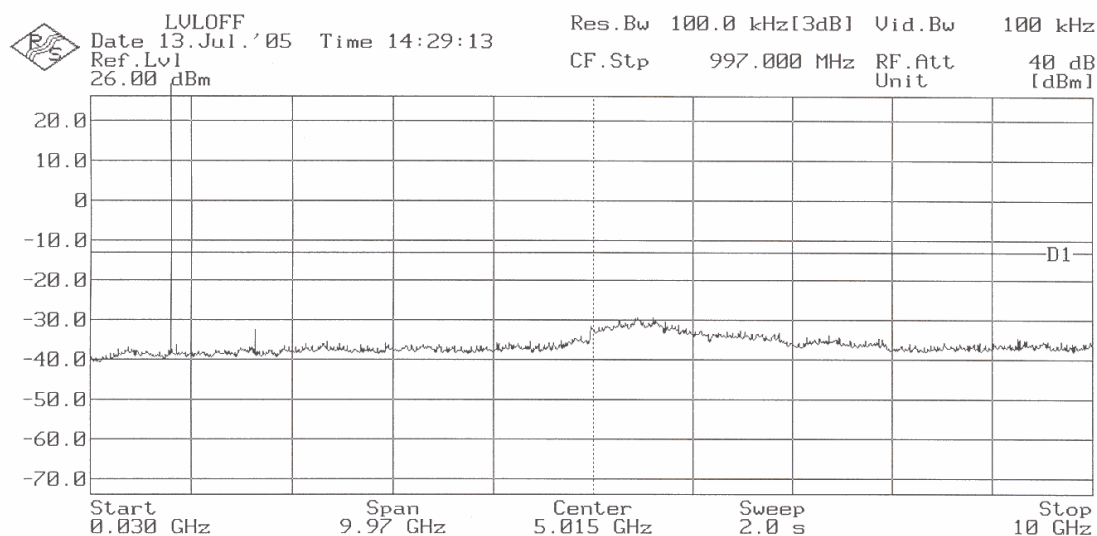
3. CHANNEL: HIGHEST (848.8 MHz).

No spurious signals were found in all the range.

Verdict: PASS

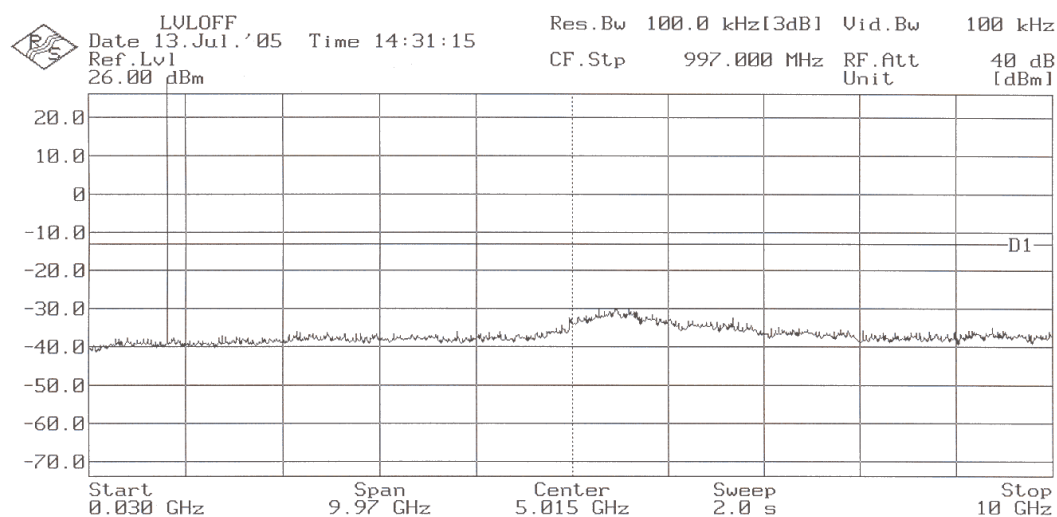
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1. CHANNEL: LOWEST (824.2 MHz).



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

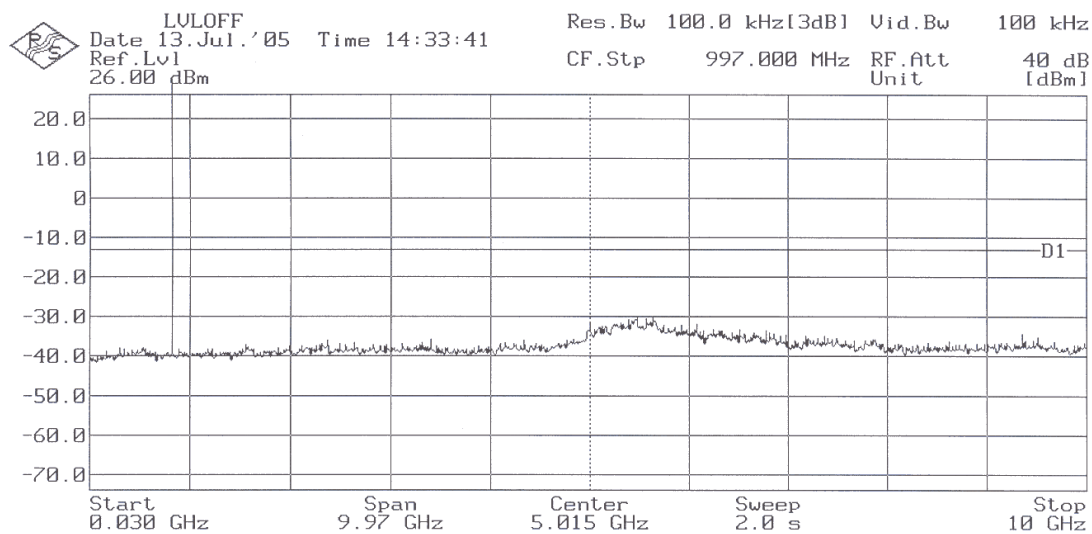
2. CHANNEL: MIDDLE (836.6 MHz).



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.

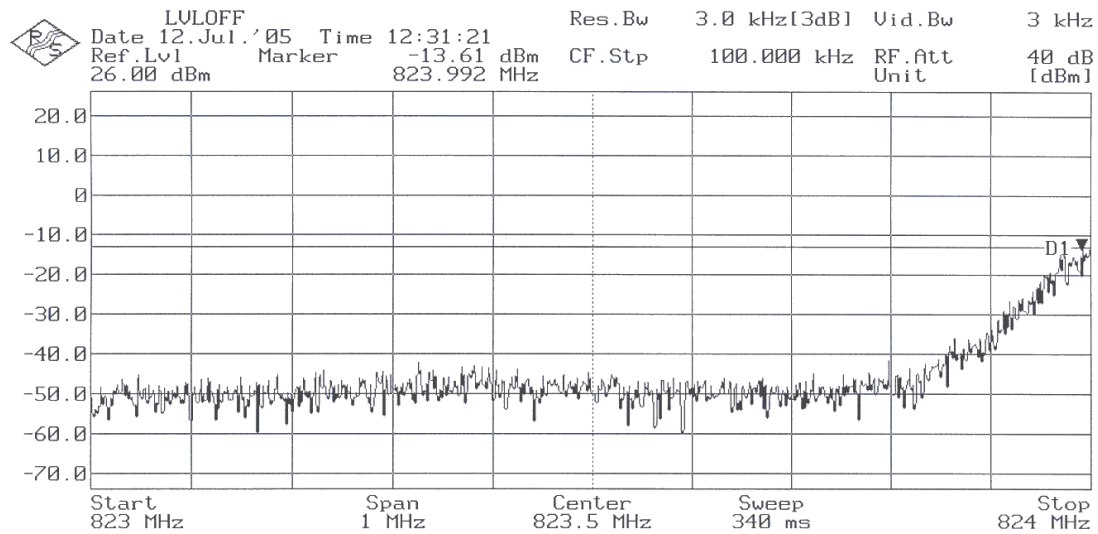
At P_o transmitting power, the specified minimum attenuation becomes $43 + 10 \log (P_o)$, and the level in dBm relative P_o becomes:

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

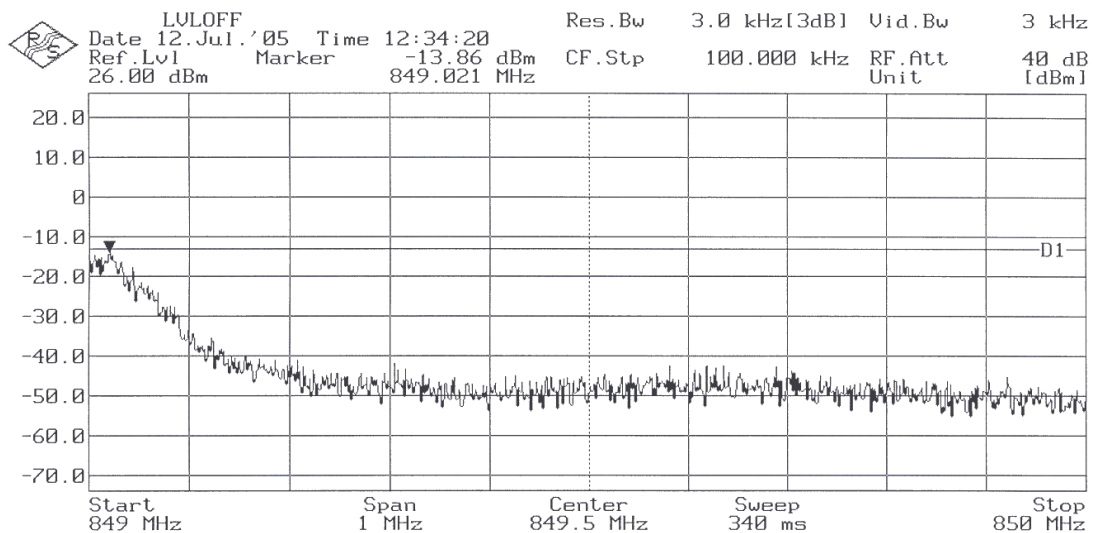
RESULTS (see plots in next pages)

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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.

No spurious signals were found in all the range.

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.

No spurious signals were found in all the range.

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.

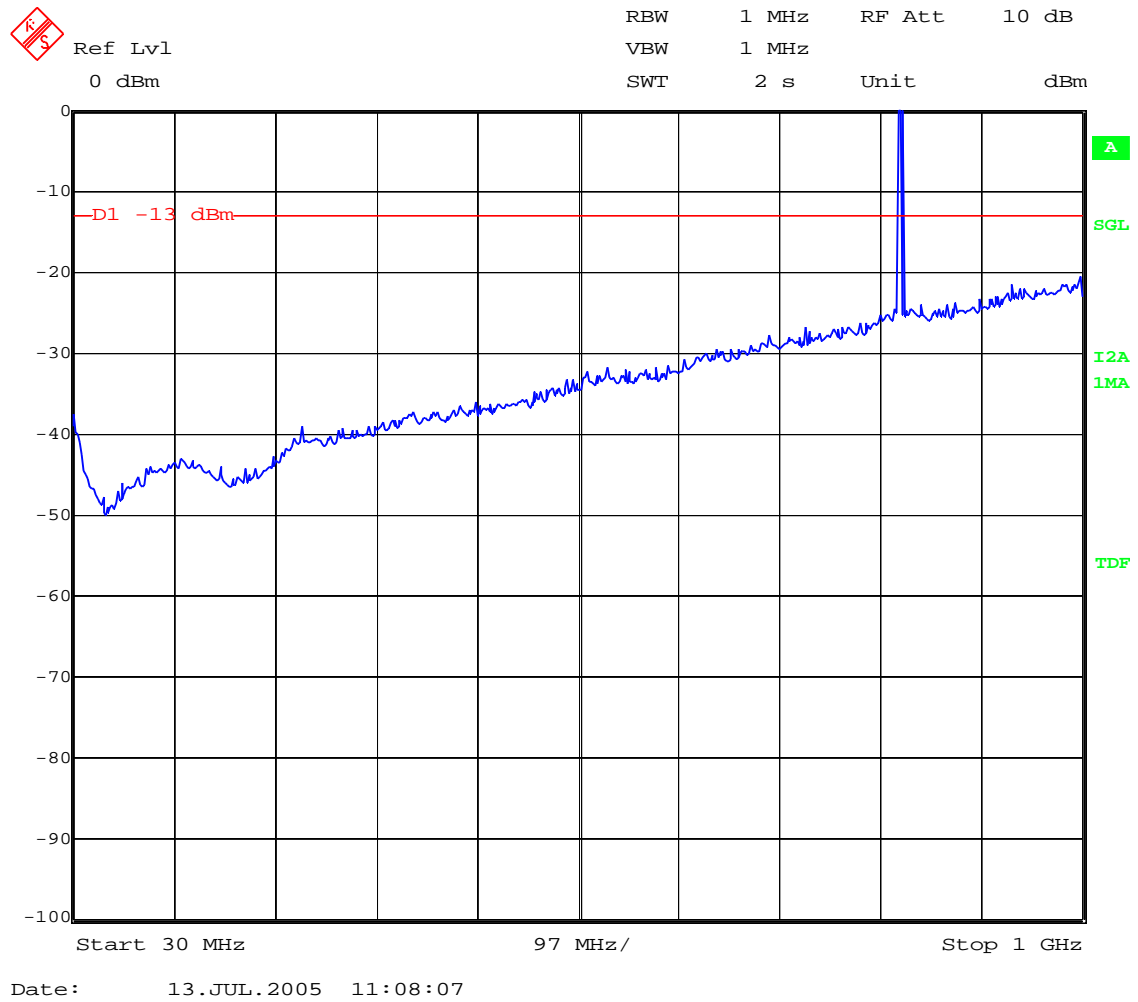
No spurious signals were found in all the range.

Verdict: PASS

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FREQUENCY RANGE 30 MHz-1000 MHz.

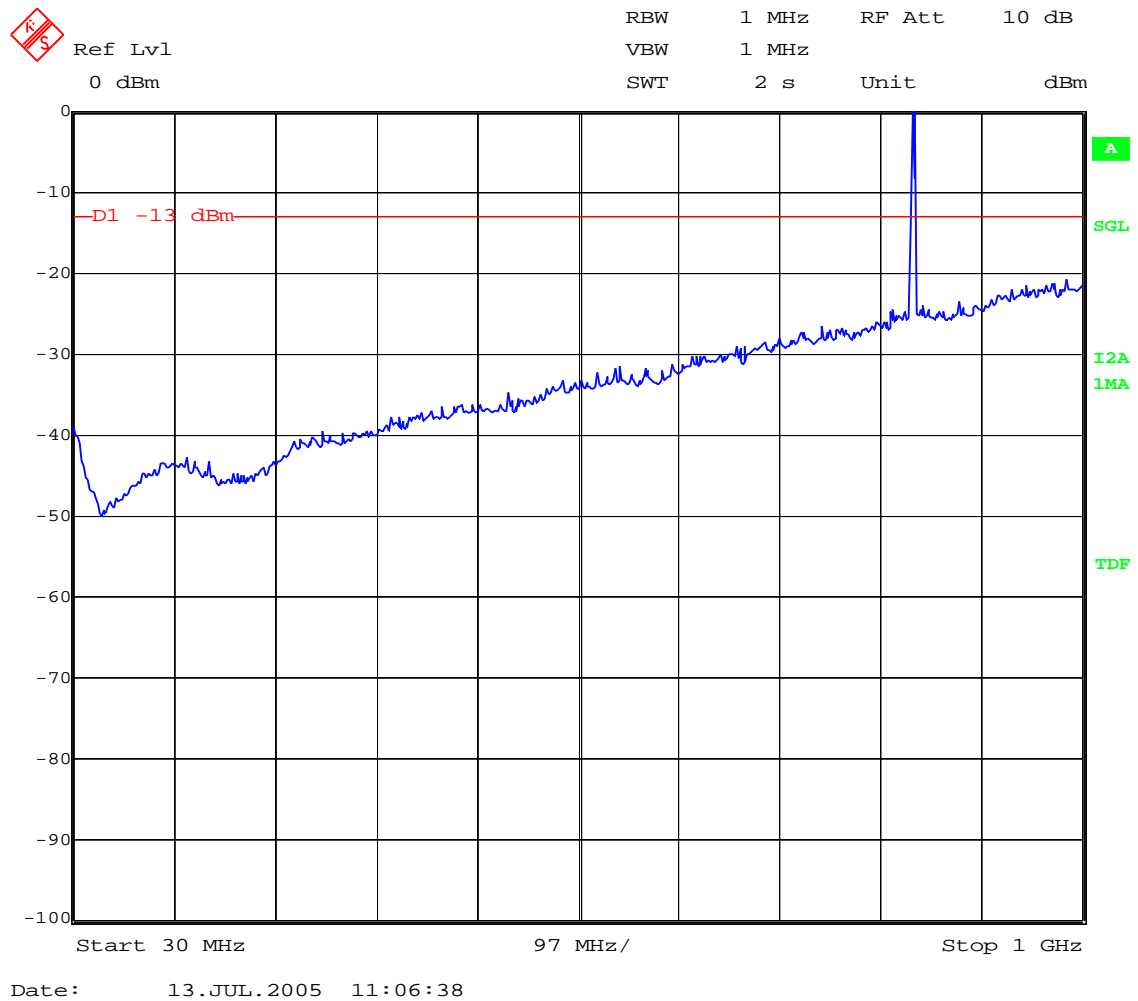
CHANNEL: LOWEST (824.2 MHz)



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

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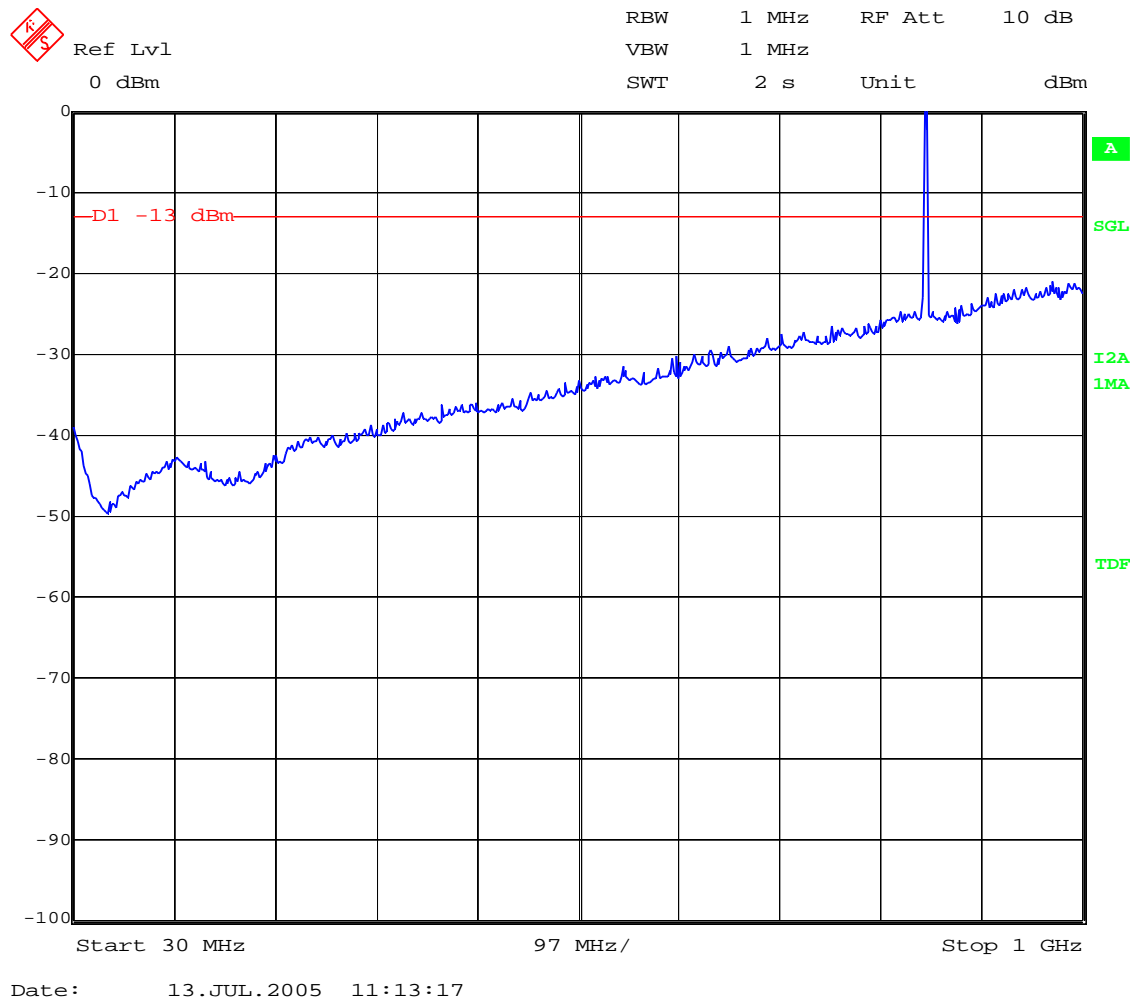
CHANNEL: MIDDLE (836.6 MHz)



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

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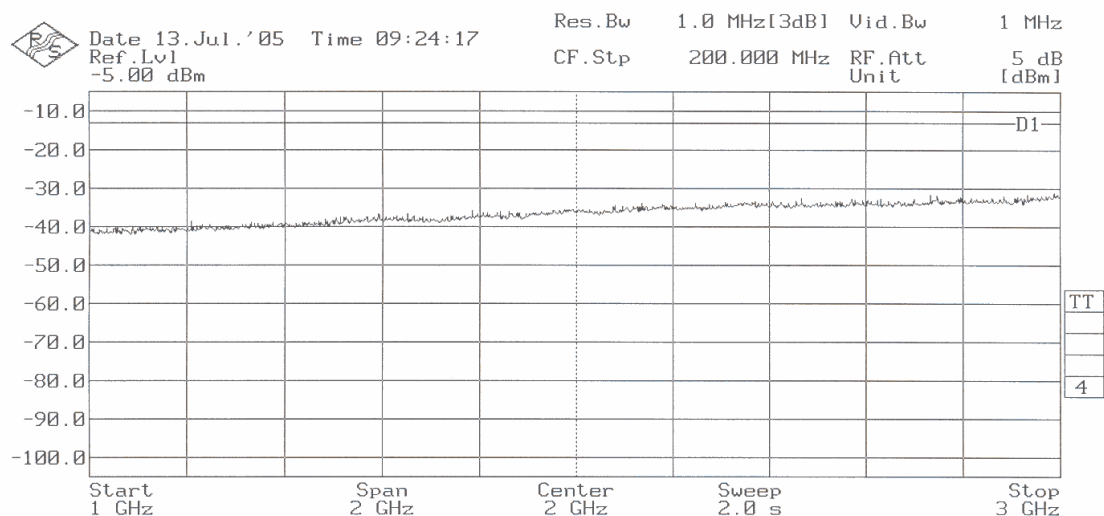
CHANNEL: HIGHEST (848.8 MHz)



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

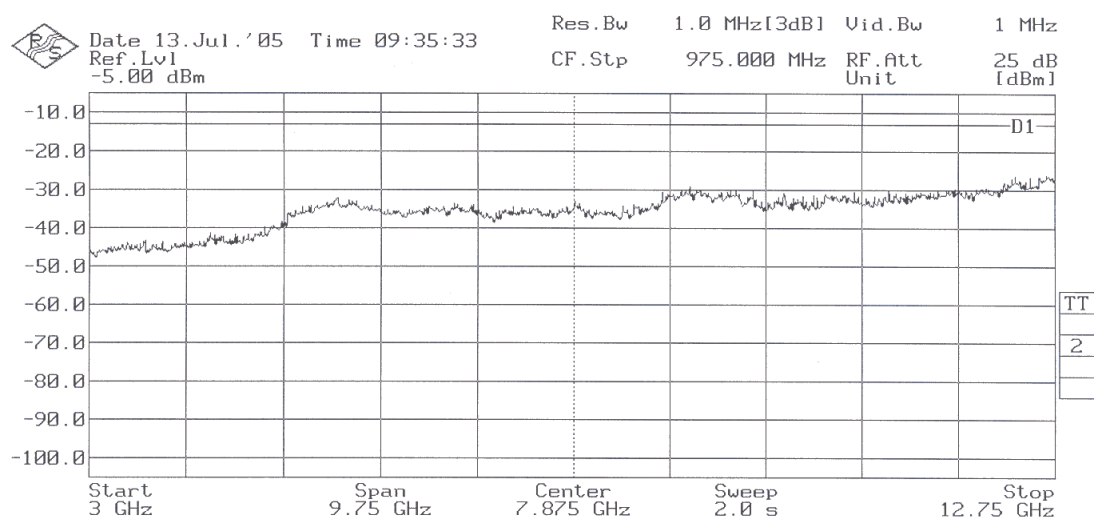
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FREQUENCY RANGE 1 GHz to 3 GHz.



(This plot is valid for all three channels).

FREQUENCY RANGE 3 GHz to 12.75 GHz.



(This plot is valid for all three channels).

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ANNEX B
TEST RESULTS FOR FCC PART 24
MODEL TSM2

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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 rechargeable battery

Type of antenna = Integral antenna

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)	28.54	28.18	28.46
Maximum peak power (W)	0.71	0.66	0.70
Measurement uncertainty (dB)	± 1.5		

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

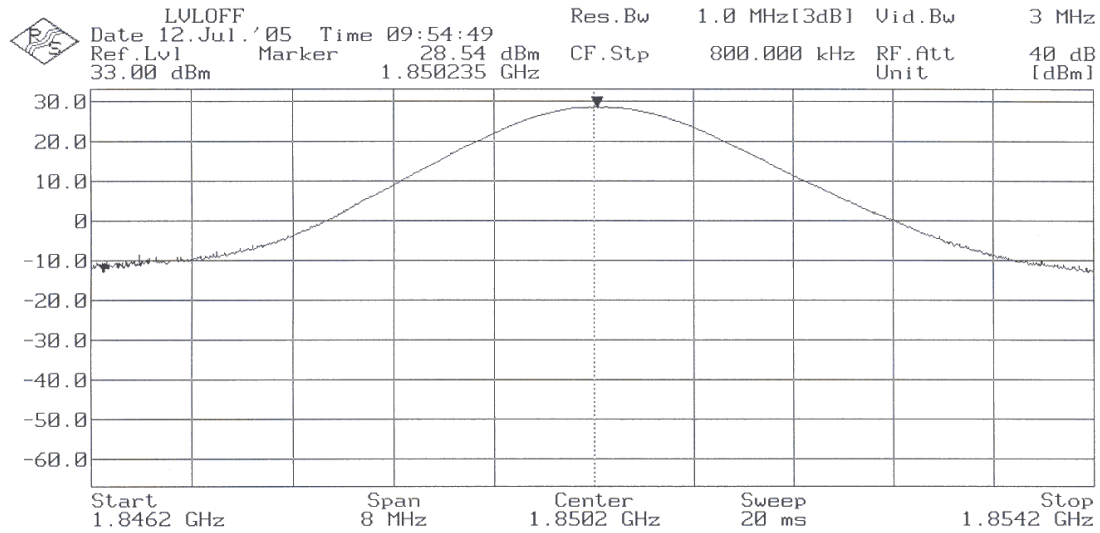
Channel	Lowest	Middle	Highest
Maximum peak power (dBm)	27.36	26.00	25.15
Maximum peak power (W)	0.54	0.40	0.33
Measurement uncertainty (dB)	± 4.0		

Verdict: PASS

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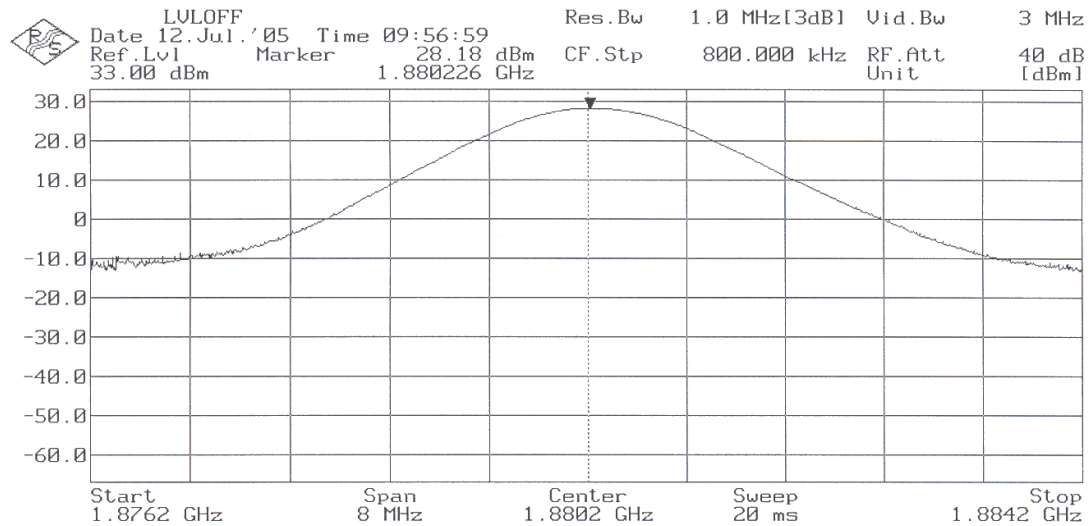
PEAK OUTPUT POWER (CONDUCTED).

Lowest Channel: 1850.2 MHz.



PEAK OUTPUT POWER (CONDUCTED).

Middle Channel: 1880.2 MHz.



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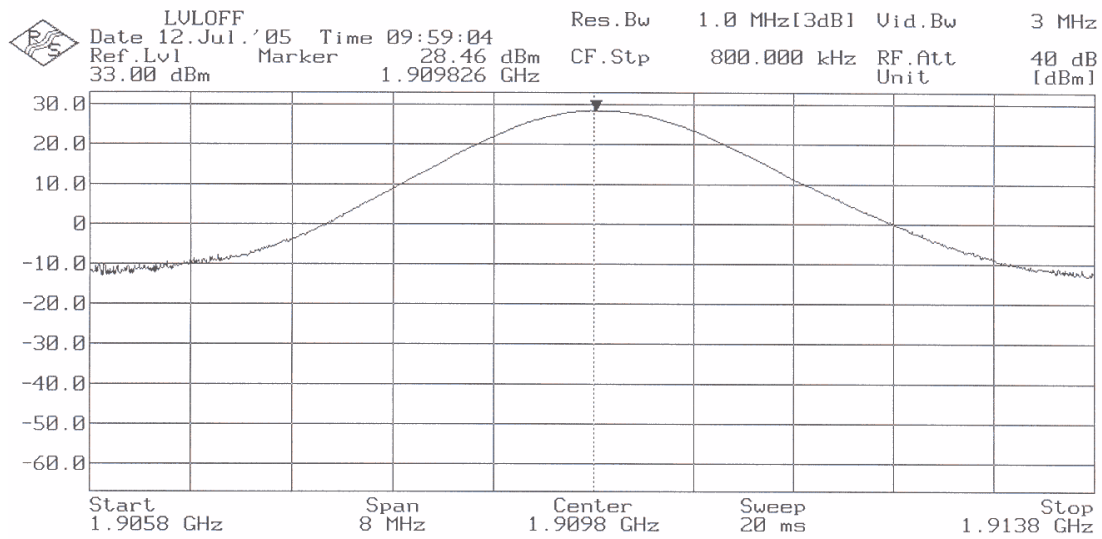
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PEAK OUTPUT POWER (CONDUCTED).

Highest Channel: 1909.8 MHz.



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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	+41	+0.0218	+0.00000218
+40	+28	+0.0149	+0.00000149
+30	+26	+0.0138	+0.00000138
+20	+17	+0.0090	+0.00000090
+10	+10	+0.0053	+0.00000053
0	-1	-0.0005	-0.00000005
-10	+5	+0.0027	+0.00000027
-20	+6	+0.0032	+0.00000032
-30	+8	+0.0043	+0.00000043

Frequency stability over voltage variations.

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)	Frequency Error (%)
Vmax	4.2	+34	+0.0181	+0.00000181
Vmin	3.4	+28	+0.0149	+0.00000149

Verdict: PASS

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Annex B

Occupied Bandwidth

SPECIFICATION

§2.1049

METHOD

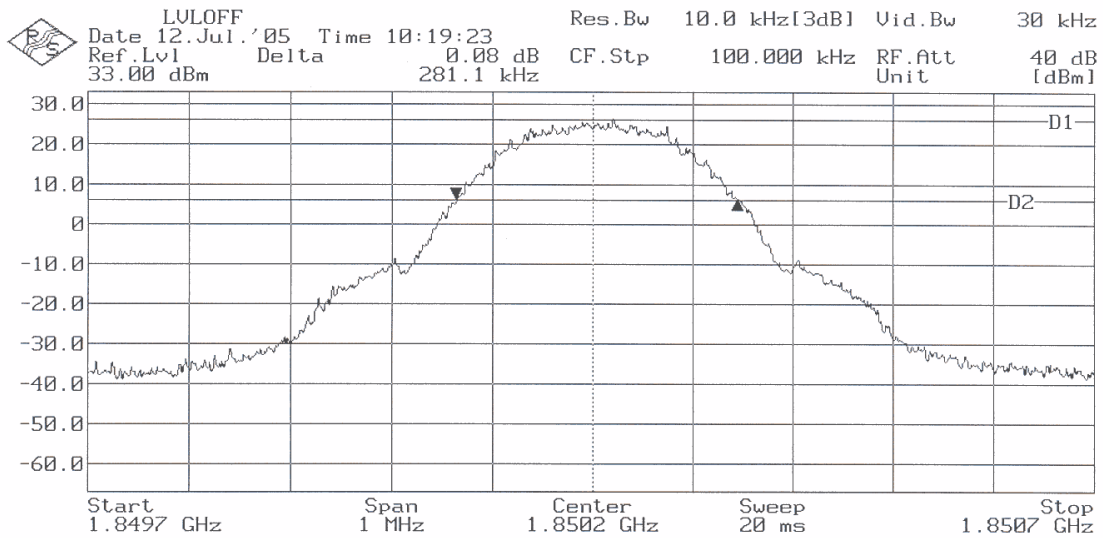
The EUT was configured to transmit a GMSK modulated carrier signal. An IF bandwidth of 10 kHz was used to determined the occupied bandwidth of the modulated emission.

RESULTS

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	281.1	290.0	278.8
Measurement uncertainty (Hz)	± 11		

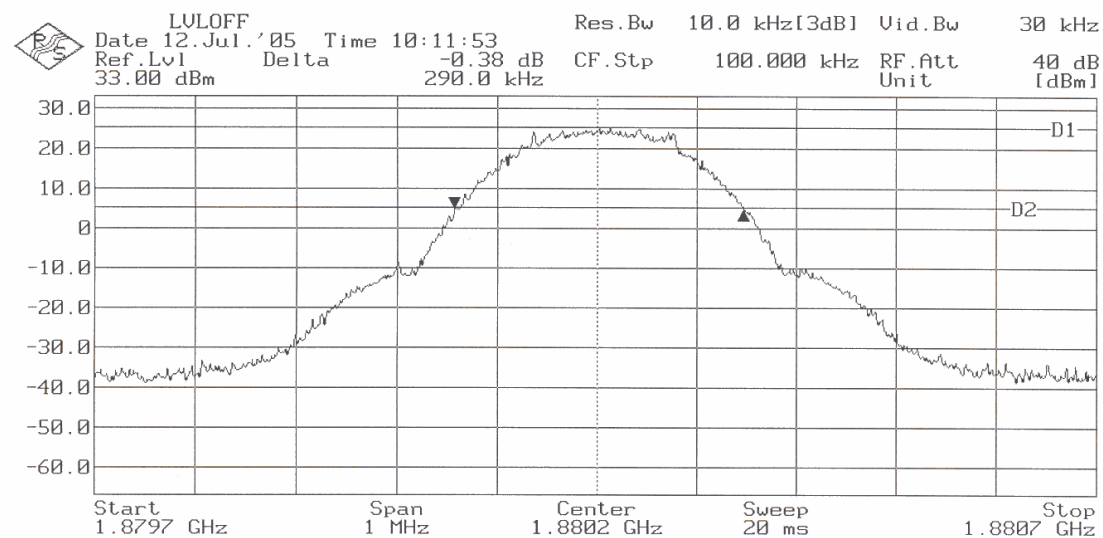
99% OCCUPIED BANDWIDTH

Lowest Channel: 1850.2 MHz.



99% OCCUPIED BANDWIDTH

Middle Channel: 1880.2 MHz.



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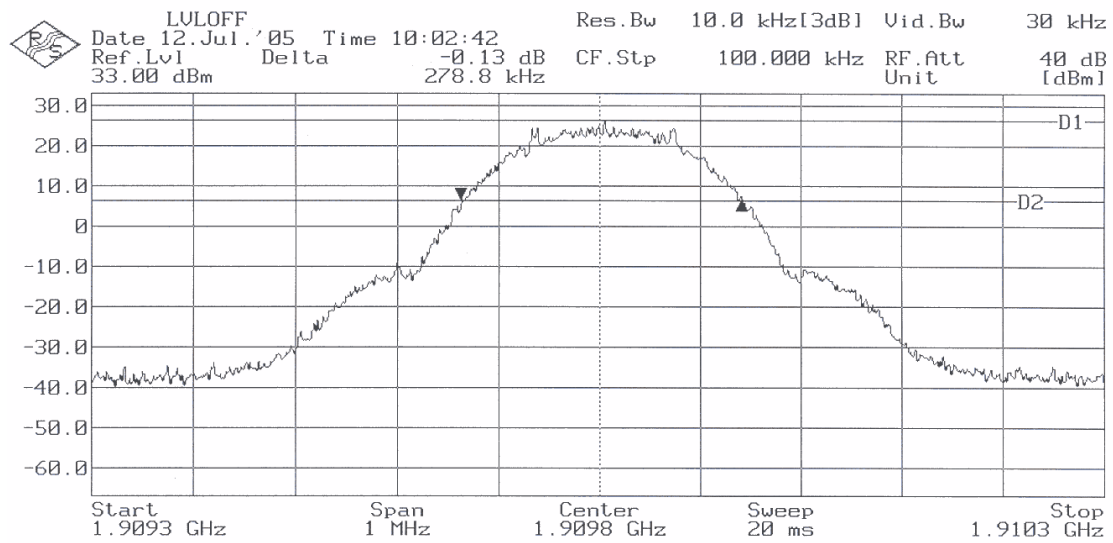
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99% OCCUPIED BANDWIDTH

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 an spectrum analyser using an 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.

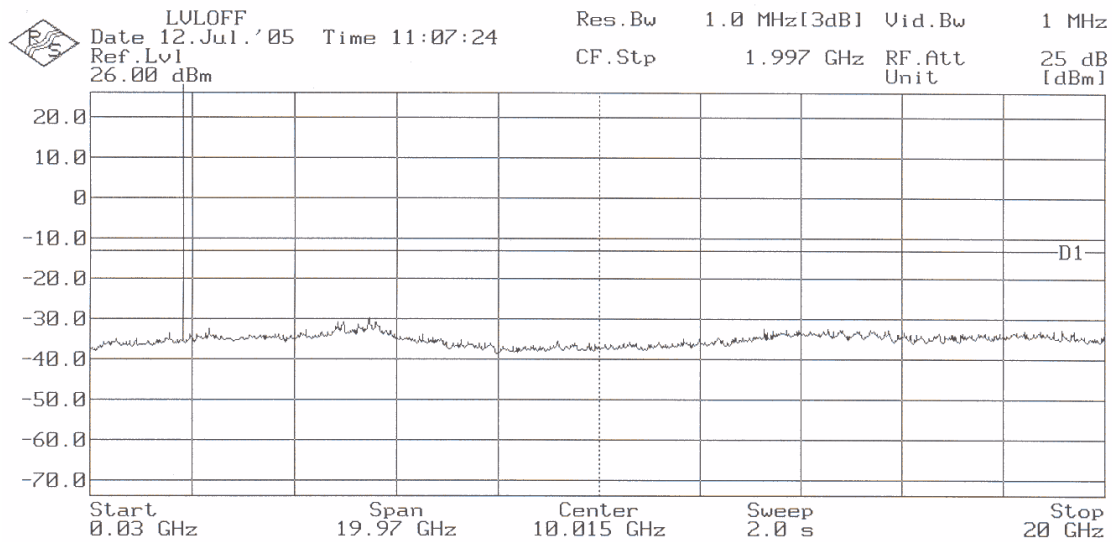
3. CHANNEL: HIGHEST (1909.8 MHz).

No spurious signals were found in all the range.

Verdict: PASS

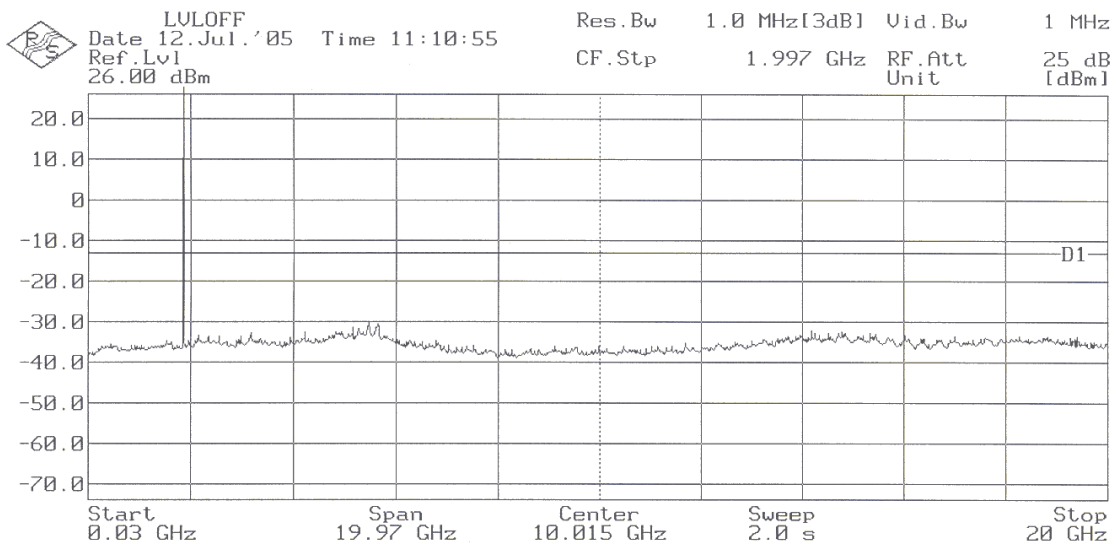
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1. CHANNEL: LOWEST (1850.2 MHz).



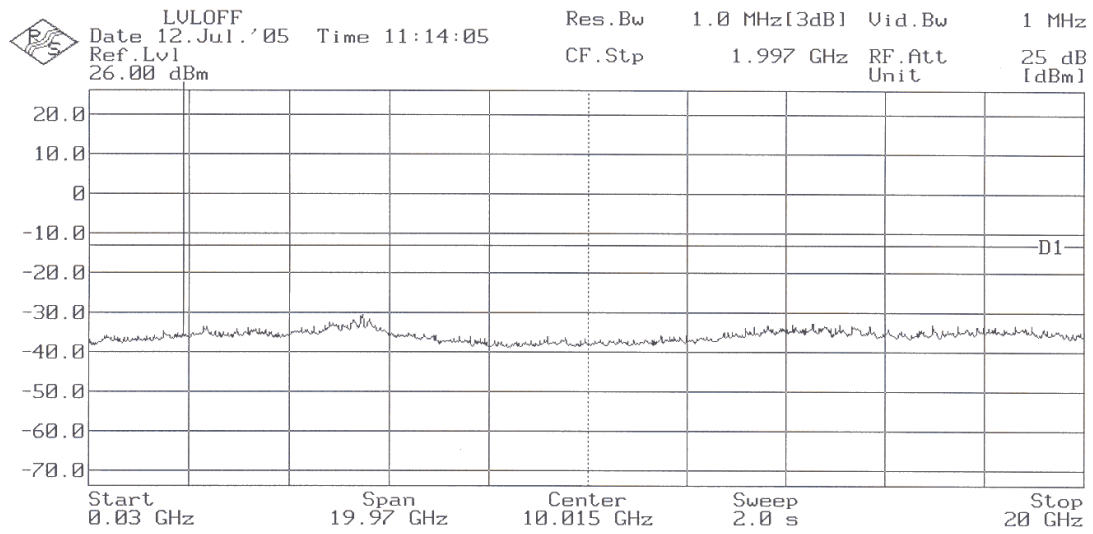
Note: The peak above the limit is the carrier frequency.

2. CHANNEL: MIDDLE (1880.2 MHz).



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

3. CHANNEL: HIGHEST (1909.8 MHz).



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

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Annex B

Spurious emissions at antenna terminals at Block EdgesSPECIFICATION

§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.

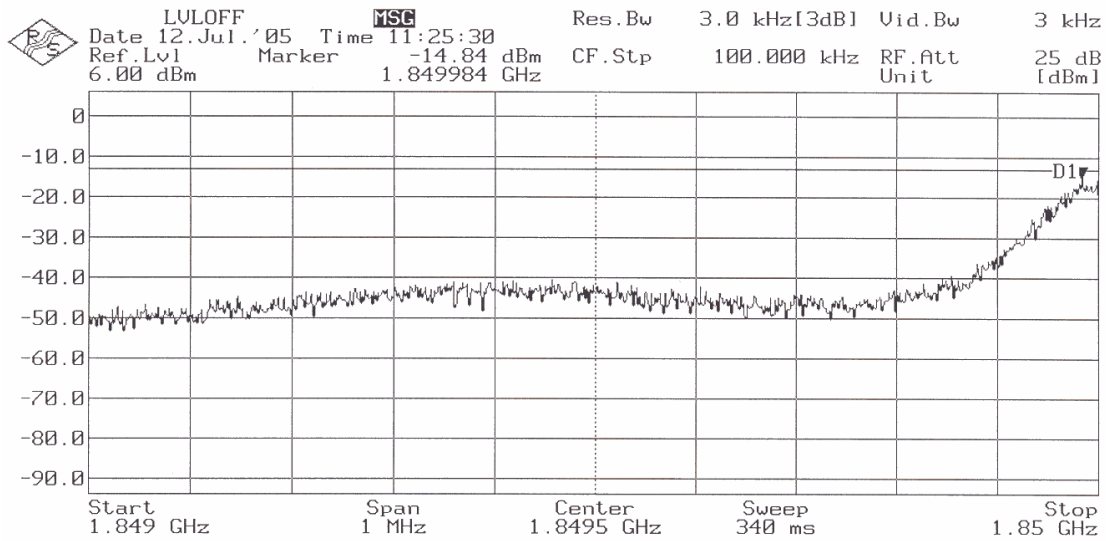
At P_o transmitting power, the specified minimum attenuation becomes $43 + 10 \log (P_o)$, and the level in dBm relative P_o becomes:

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

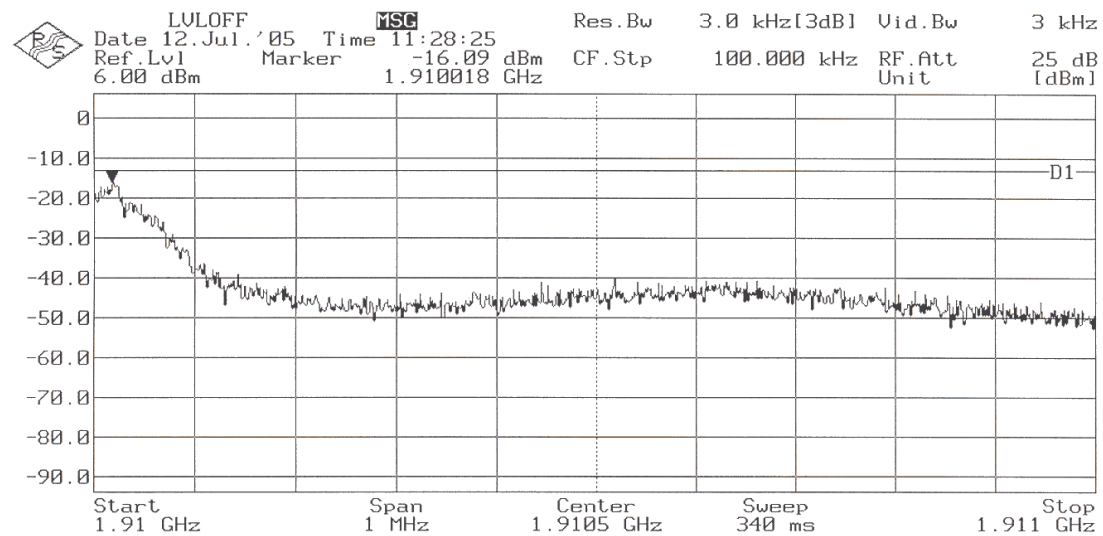
RESULTS (see plots in next pages)

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BLOCK A. CHANNEL LOWEST (1850.2 MHz).



BLOCK C. CHANNEL HIGHEST (1909.8 MHz).



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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.

No spurious signals were found in all the range.

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.

No spurious signals were found in all the range.

3. CHANNEL: HIGHEST (1909.8 MHz).

Frequency range 30 MHz-1000 MHz.

No spurious signals were found in all the range.

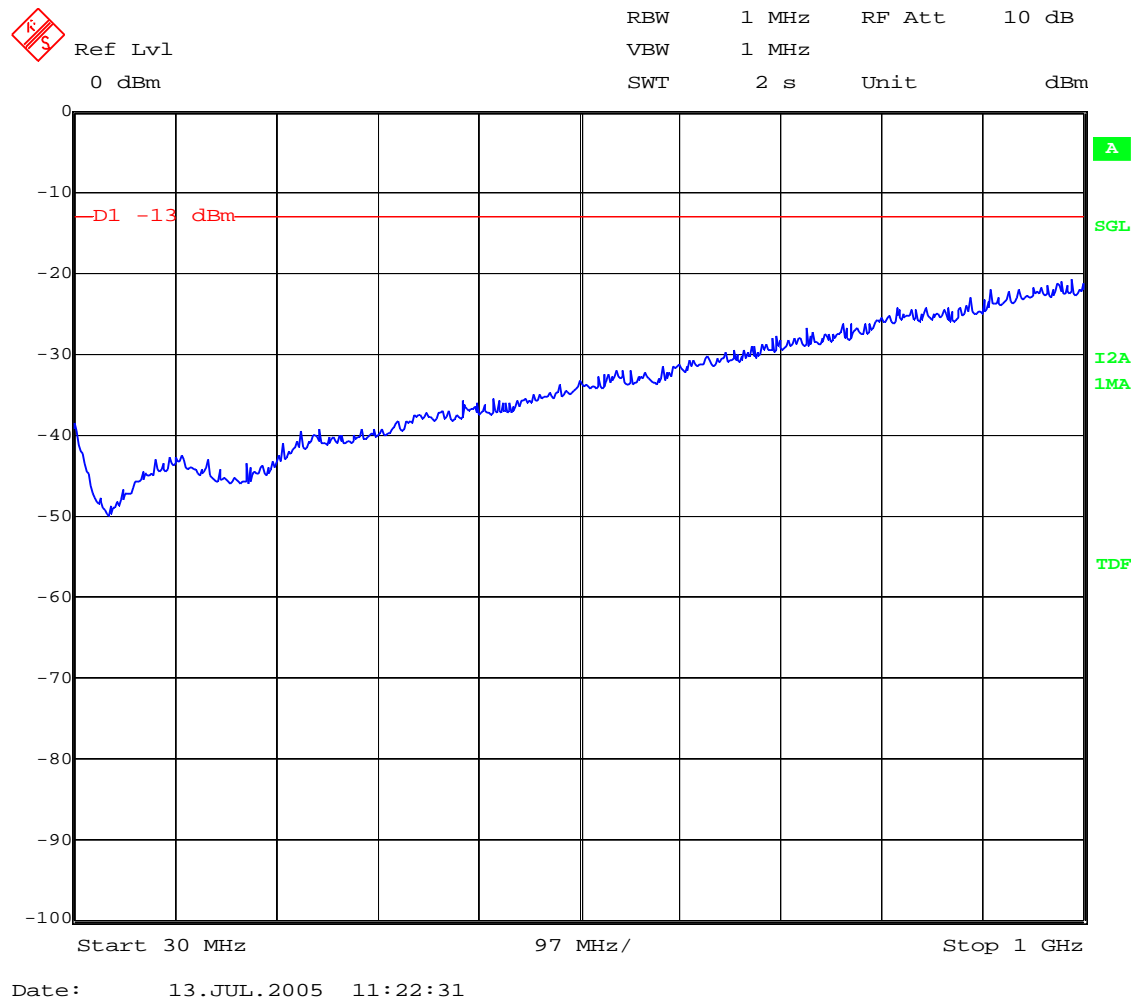
Frequency range 1 GHz-20 GHz.

No spurious signals were found in all the range.

Verdict: PASS

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FREQUENCY RANGE 30 MHz-1000 MHz.

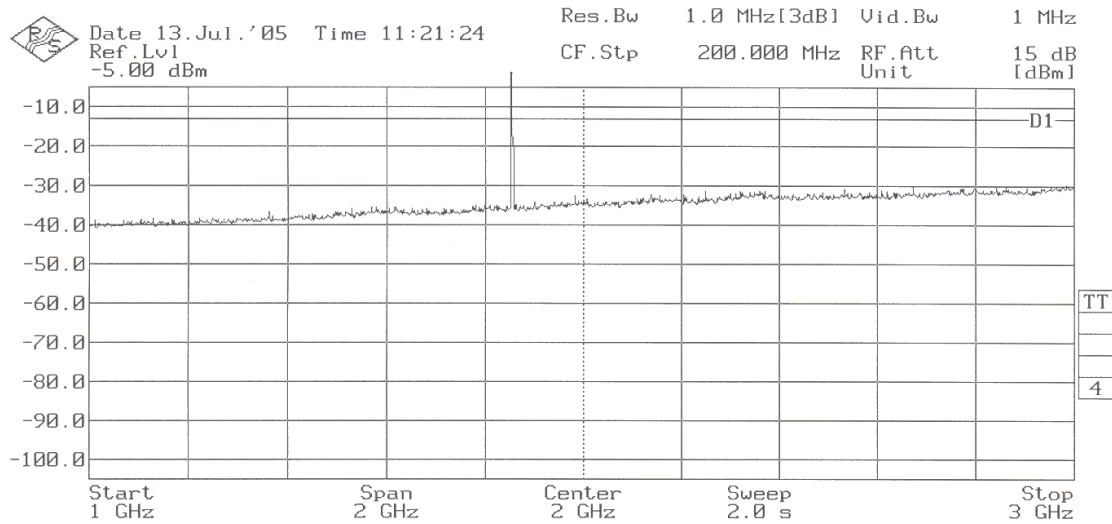


(This plot is valid for all three channels).

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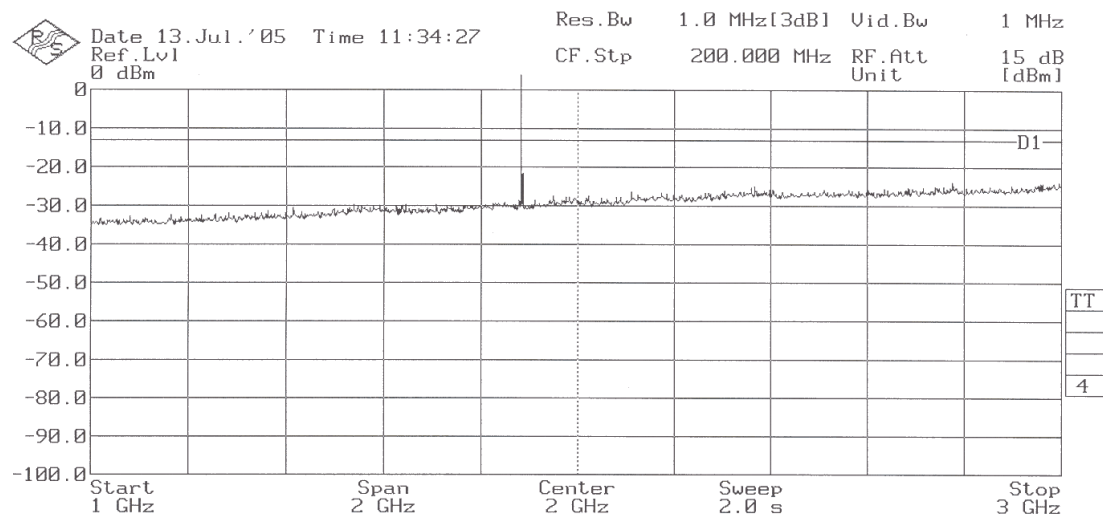
FREQUENCY RANGE 1 GHz to 3 GHz.

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.

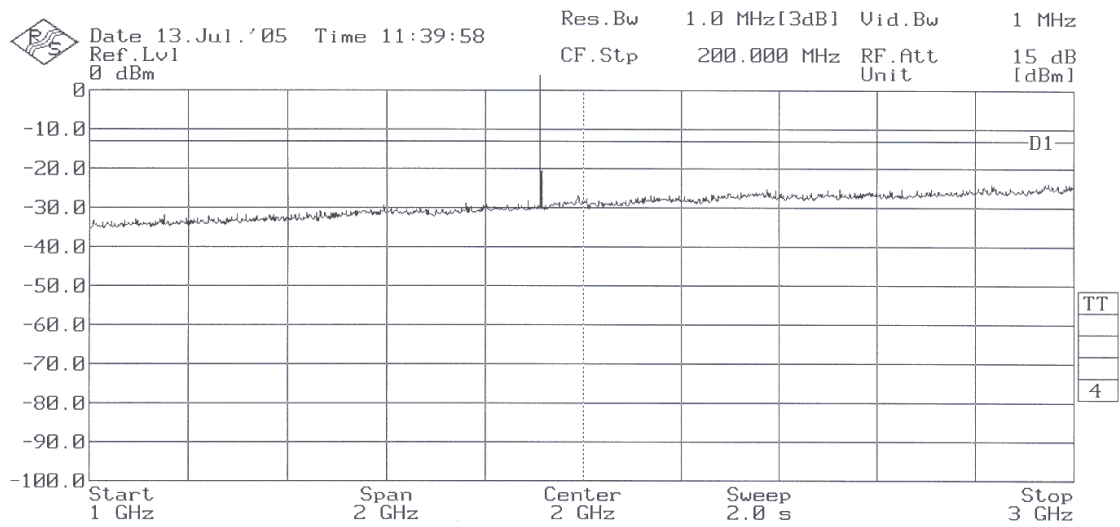
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CHANNEL: HIGHEST (1909.8 MHz)



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

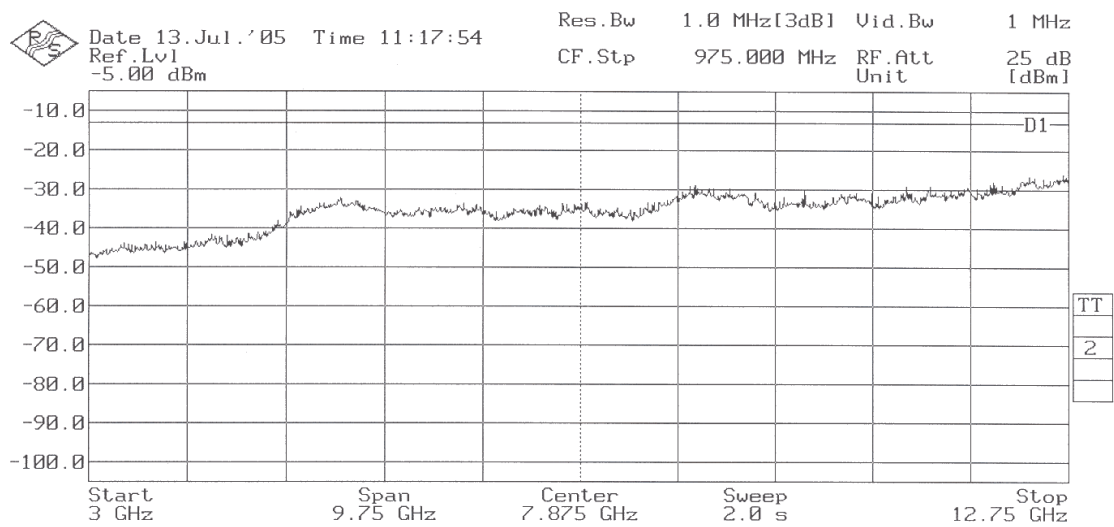
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FREQUENCY RANGE 3 GHz to 12.75 GHz.



(This plot is valid for all three channels).

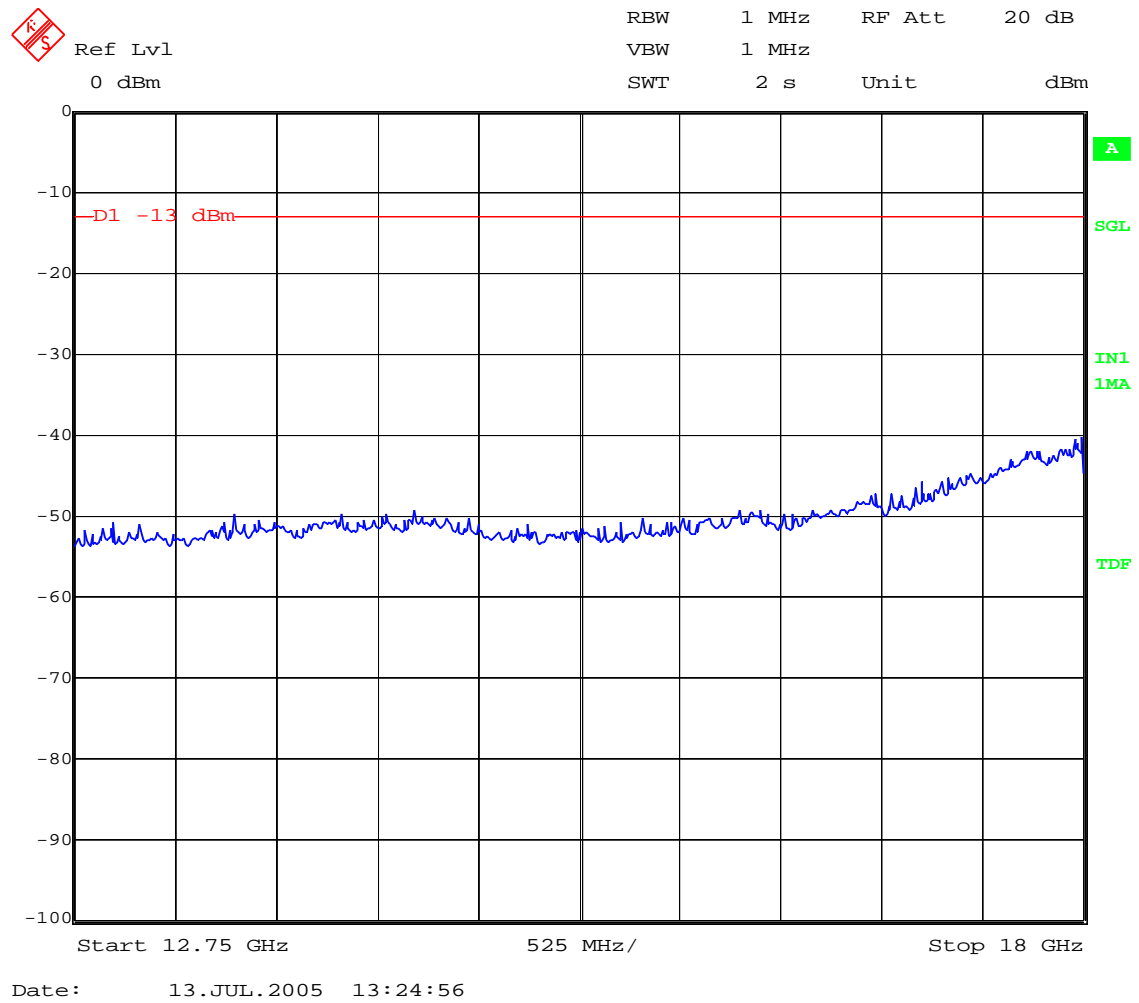
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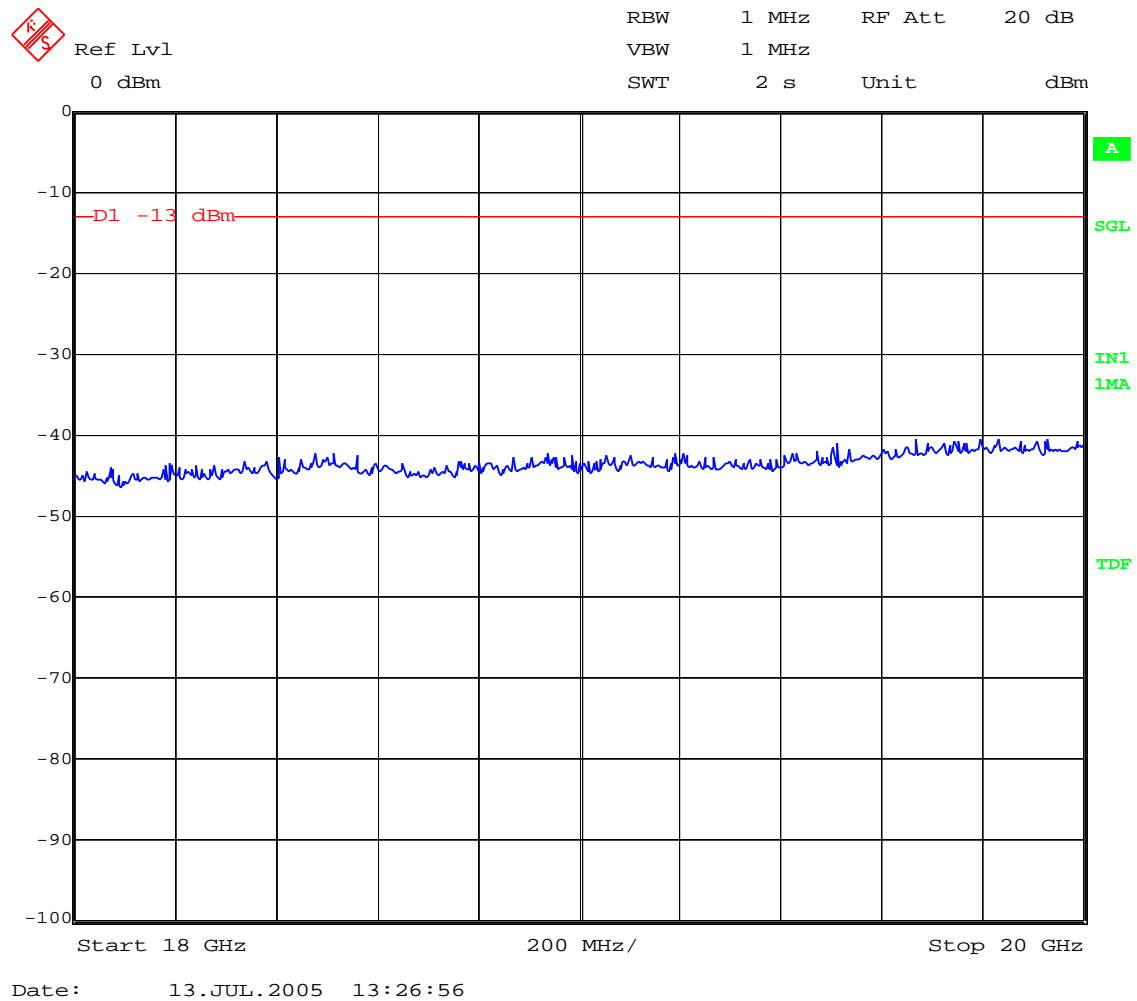
FREQUENCY RANGE 12.75 GHz TO 18 GHz.



(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
TEST RESULTS FOR FCC PART 22
MODEL TSM1

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Annex C

TEST CONDITIONS

Power supply (V):

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

$V_{\text{max}} = \text{Not applicable}$

$V_{\text{min}} = \text{Not applicable}$

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 rechargeable battery

Type of antenna = Integral antenna

TEST FREQUENCIES:

Lowest channel (128): 824.2 MHz

Middle channel (190): 836.6 MHz

Highest channel (251): 848.8 MHz

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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.

No spurious signals were found in all the range.

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.

No spurious signals were found in all the range.

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.

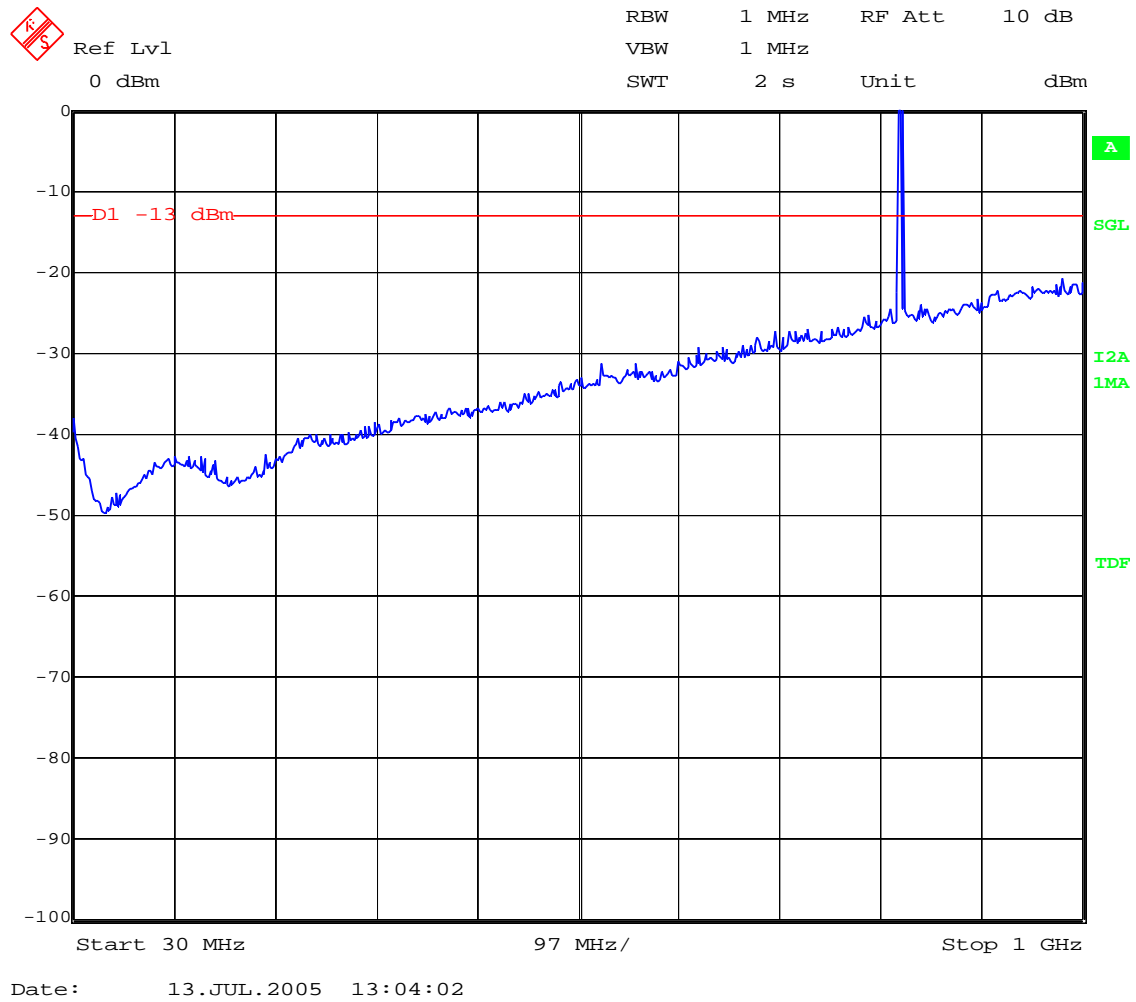
No spurious signals were found in all the range.

Verdict: PASS

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FREQUENCY RANGE 30 MHz-1000 MHz.

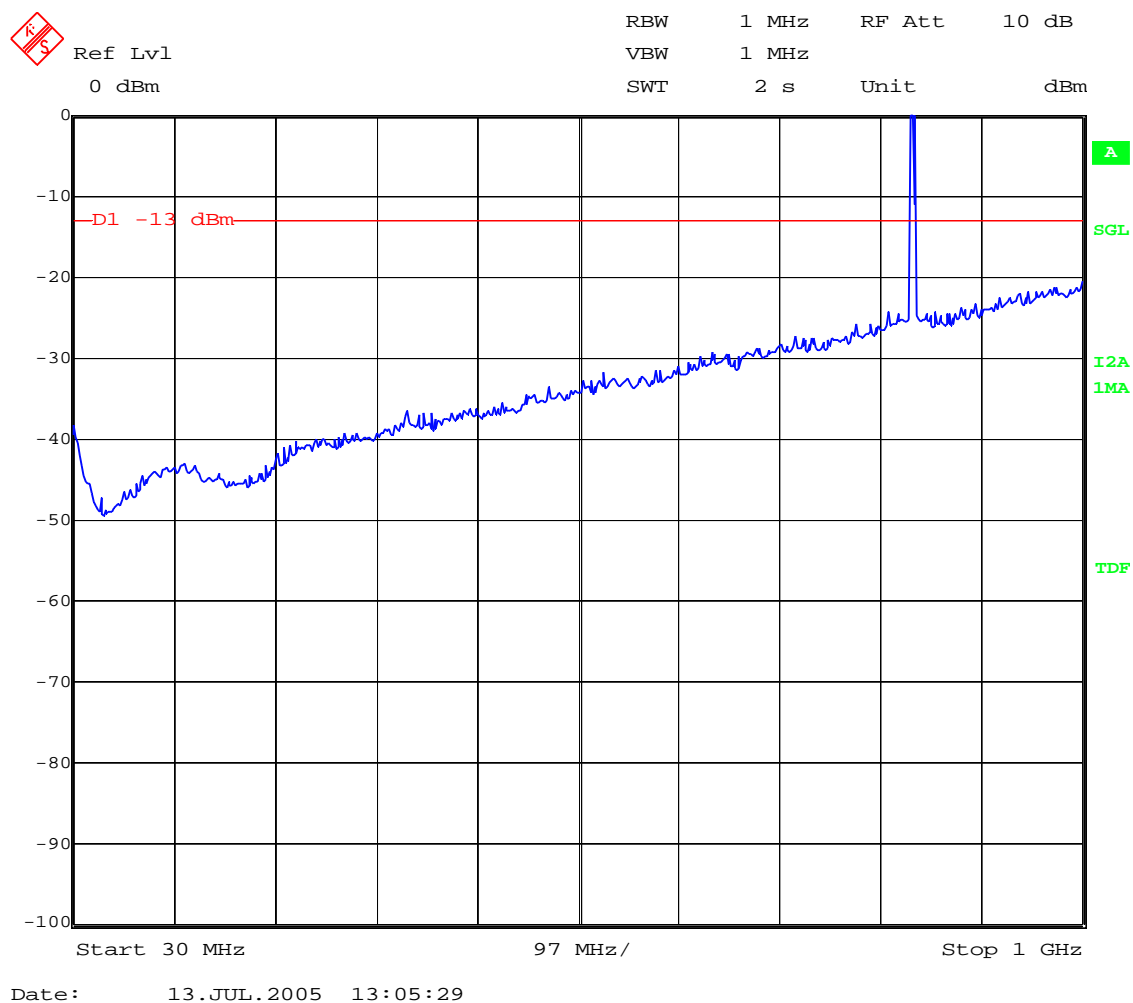
CHANNEL: LOWEST (824.2 MHz)



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

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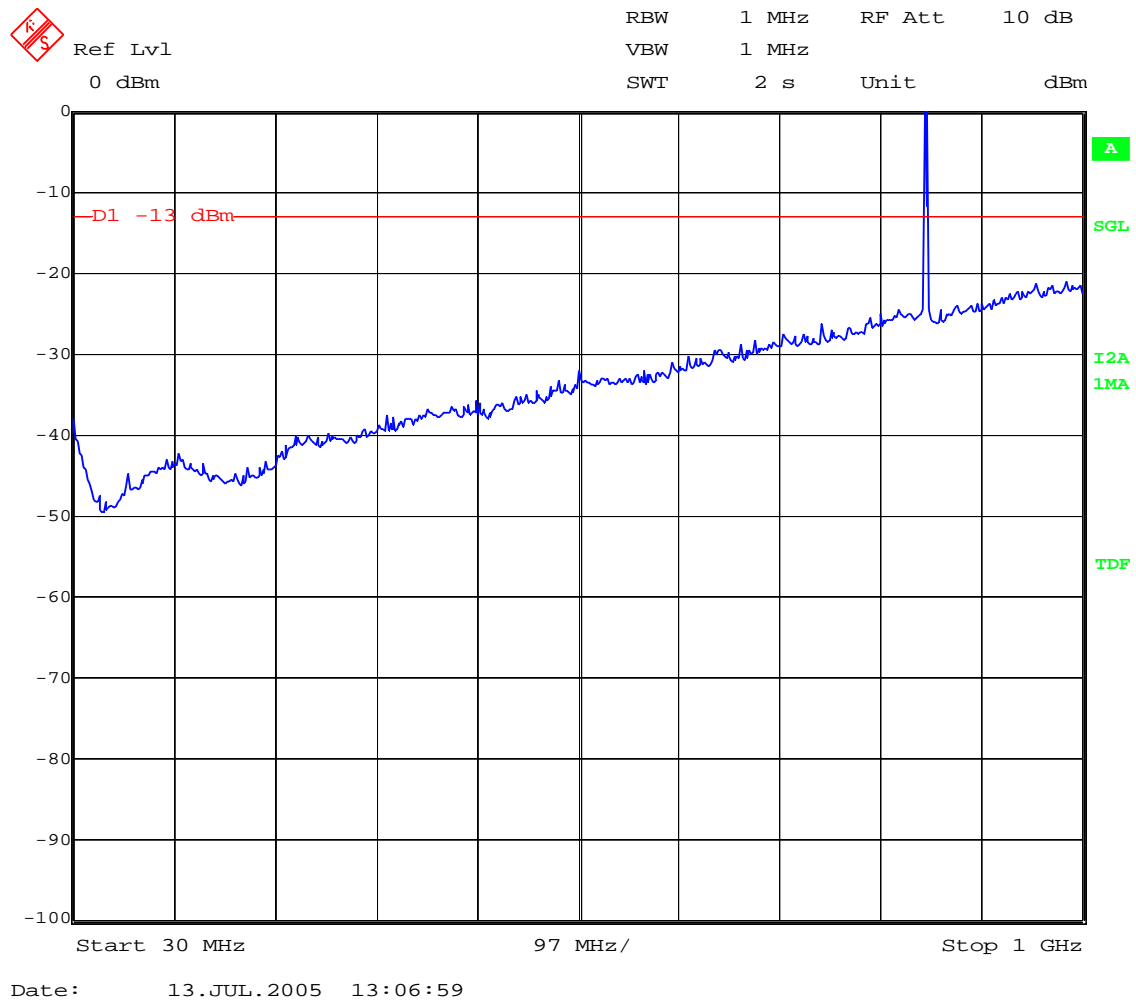
CHANNEL: MIDDLE (836.6 MHz)



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

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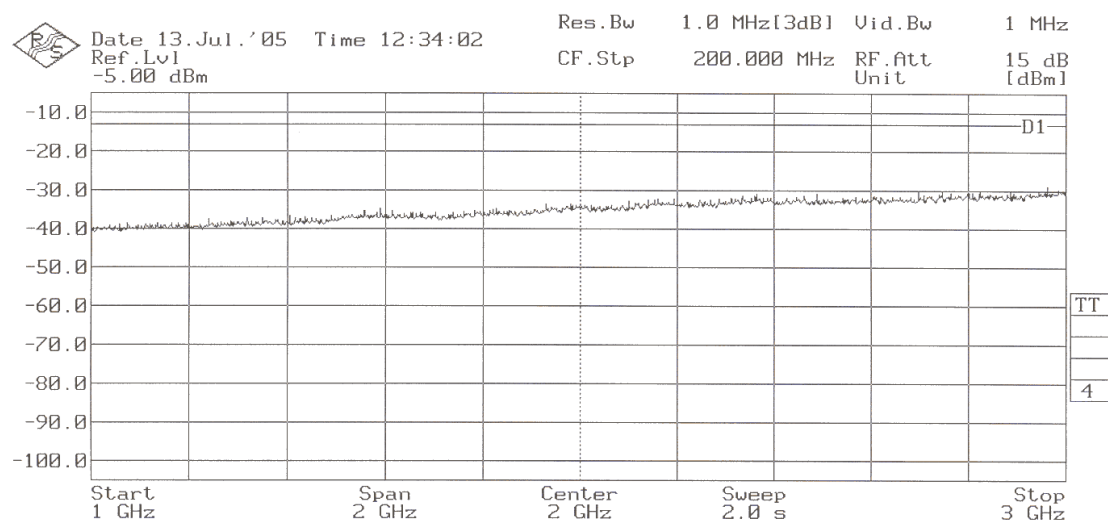
CHANNEL: HIGHEST (848.8 MHz)



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

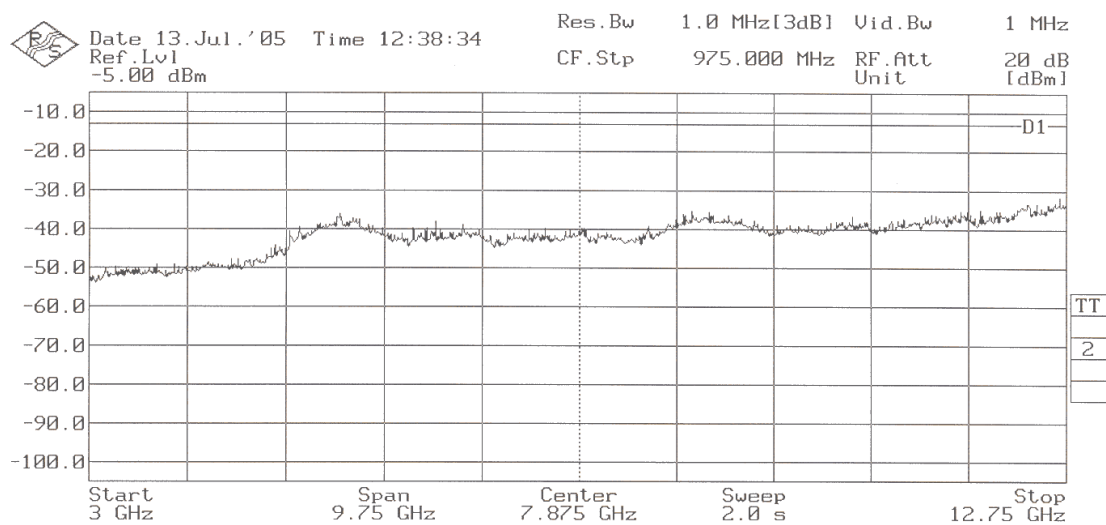
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FREQUENCY RANGE 1 GHz to 3 GHz.



(This plot is valid for all three channels).

FREQUENCY RANGE 3 GHz to 12.75 GHz.



(This plot is valid for all three channels).

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ANNEX D
TEST RESULTS FOR FCC PART 24
MODEL TSM1

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Annex D

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Annex D

TEST CONDITIONS

Power supply (V):

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

$V_{\text{max}} = \text{Not applicable}$

$V_{\text{min}} = \text{Not applicable}$

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 rechargeable battery

Type of antenna = Integral antenna

TEST FREQUENCIES:

Lowest channel (512): 1850.2 MHz

Middle channel (662): 1880.2 MHz

Highest channel (810): 1909.8 MHz

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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.

No spurious signals were found in all the range.

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.

No spurious signals were found in all the range.

3. CHANNEL: HIGHEST (1909.8 MHz).

Frequency range 30 MHz-1000 MHz.

No spurious signals were found in all the range.

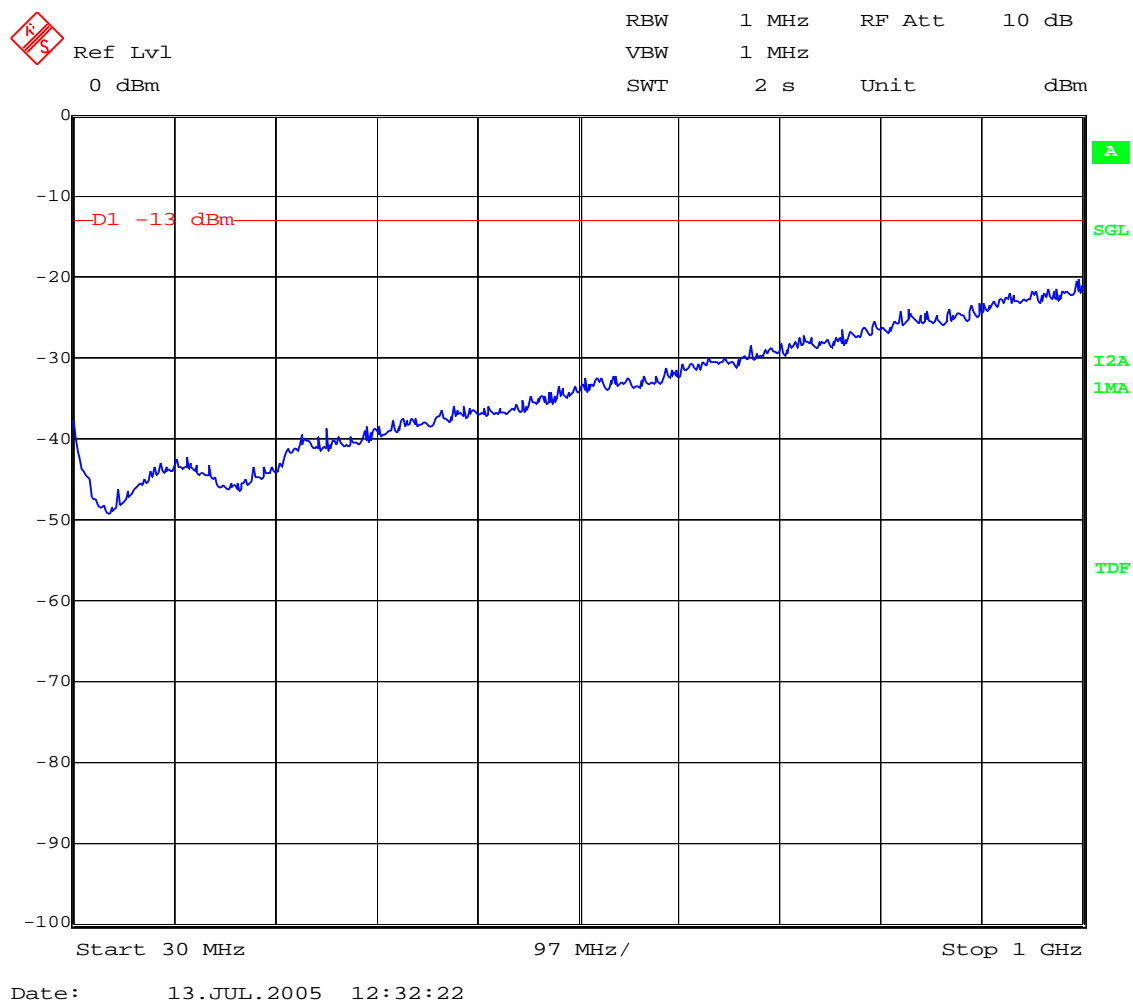
Frequency range 1 GHz-20 GHz.

No spurious signals were found in all the range.

Verdict: PASS

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FREQUENCY RANGE 30 MHz-1000 MHz.

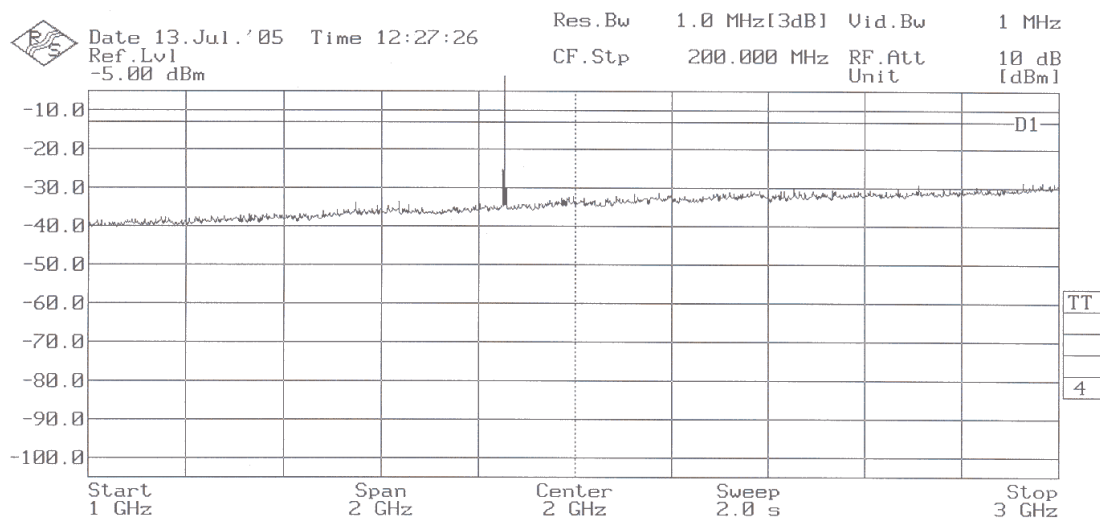


(This plot is valid for all three channels).

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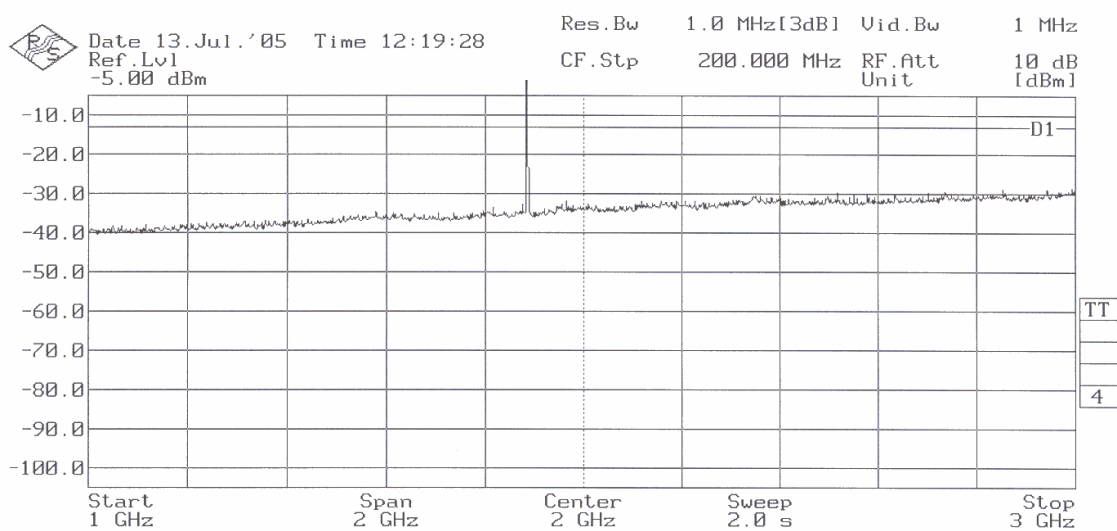
FREQUENCY RANGE 1 GHz to 3 GHz.

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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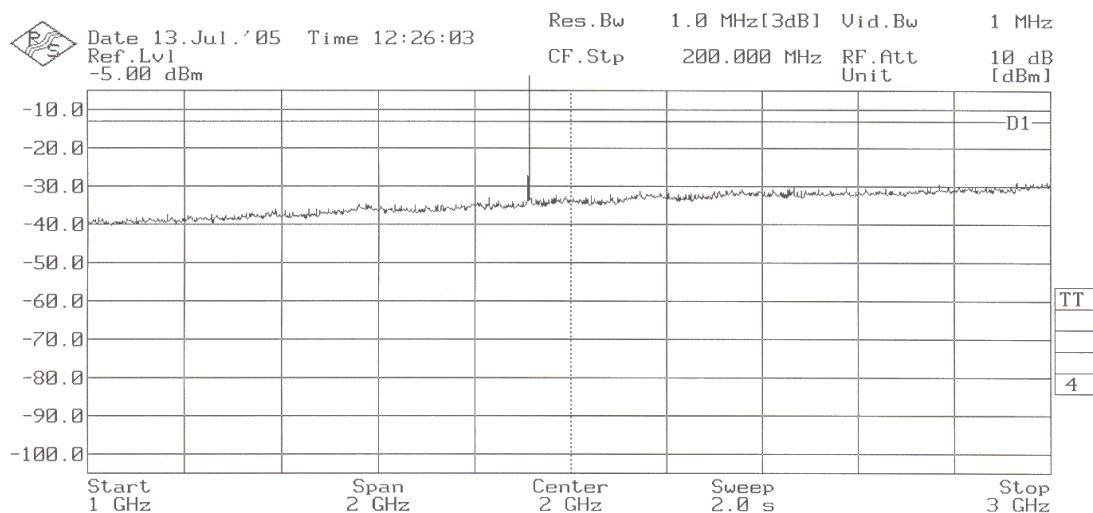
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Annex D

CHANNEL: HIGHEST (1909.8 MHz)



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

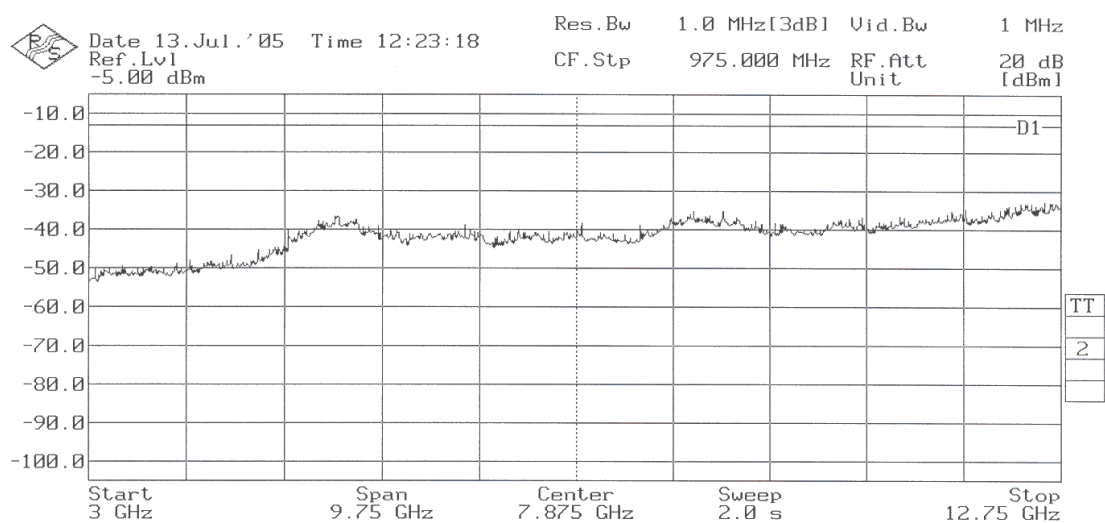
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FREQUENCY RANGE 3 GHz to 12.75 GHz.



(This plot is valid for all three channels).

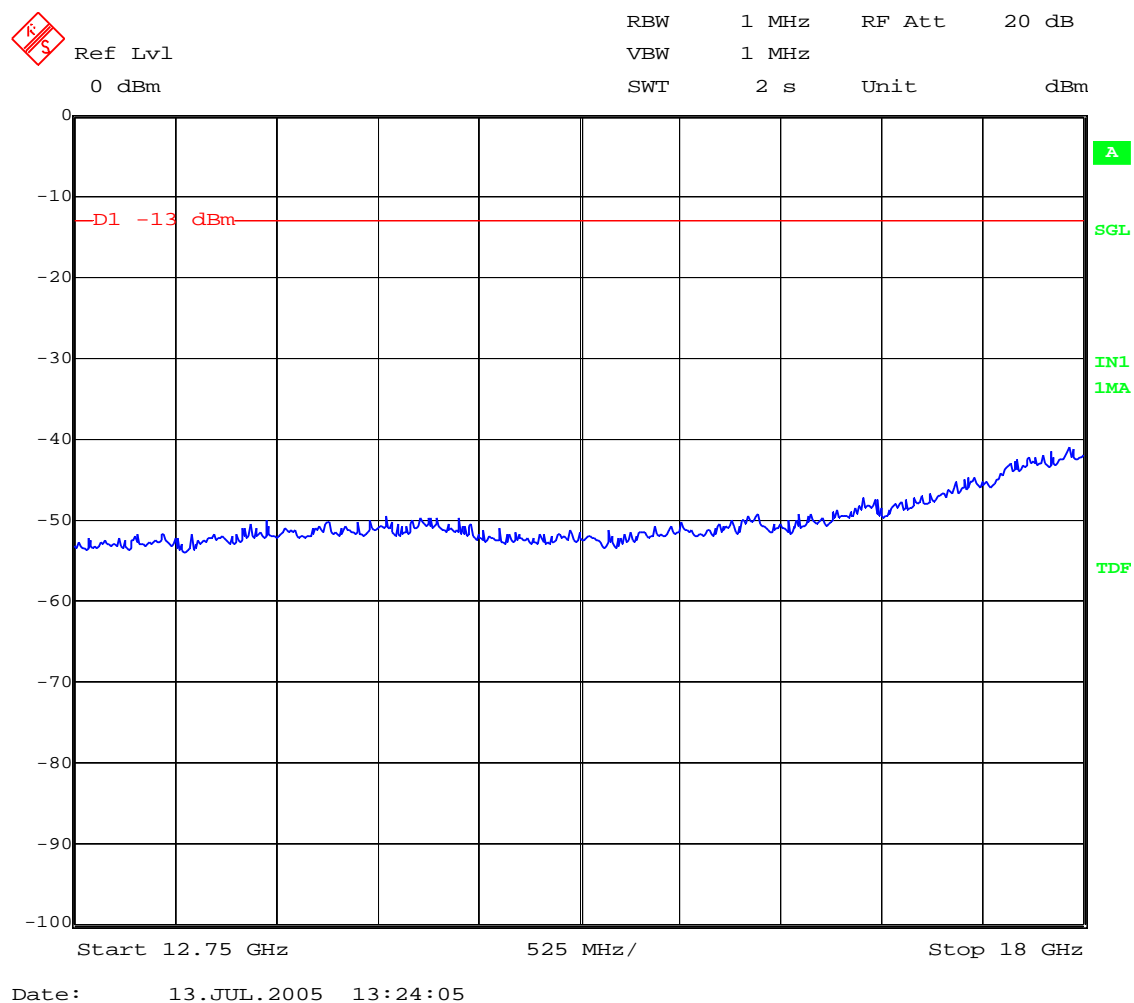
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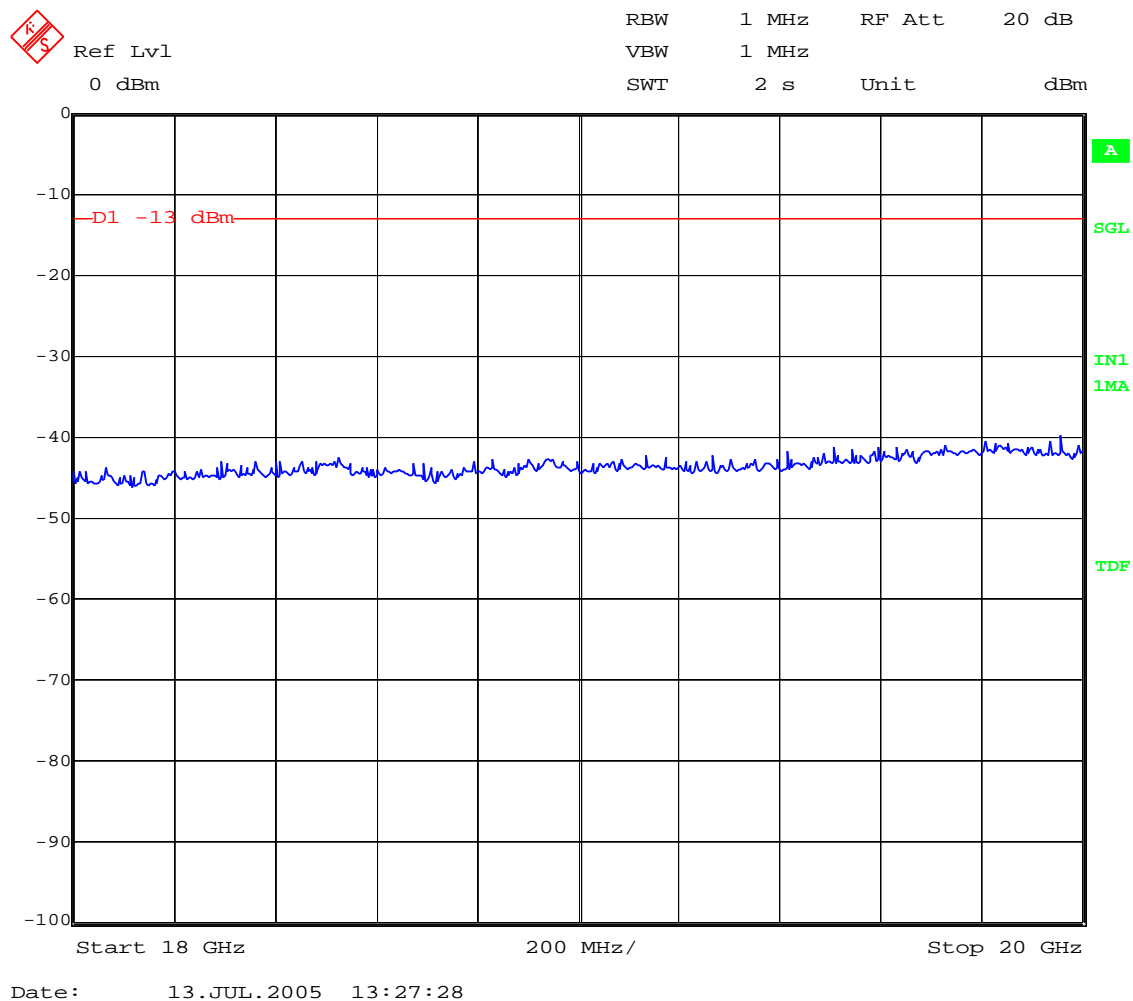
FREQUENCY RANGE 12.75 GHz TO 18 GHz.



(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 E

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

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Annex E

1. Equipment (external view)



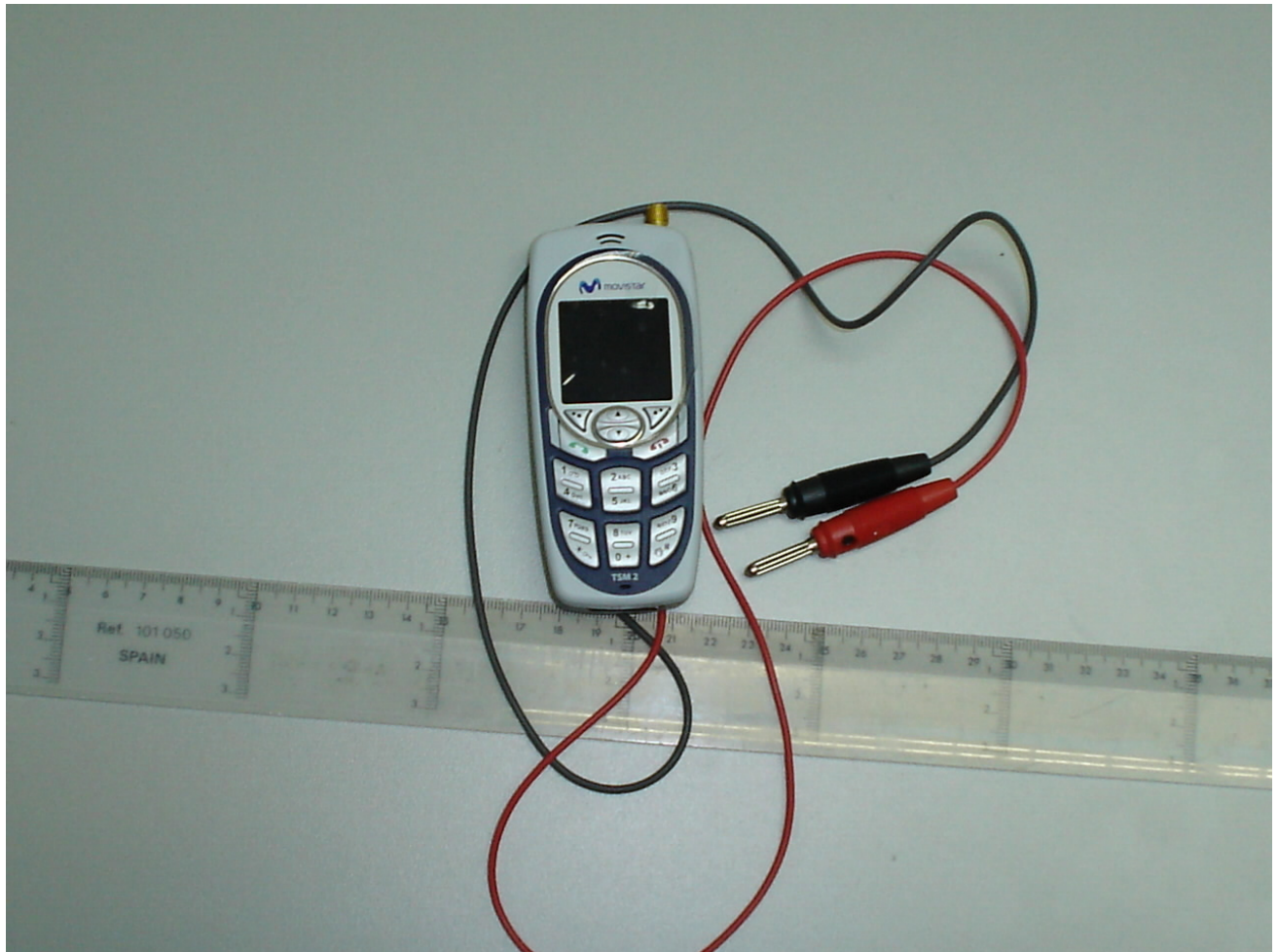
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2. Equipment for conducted measurements.



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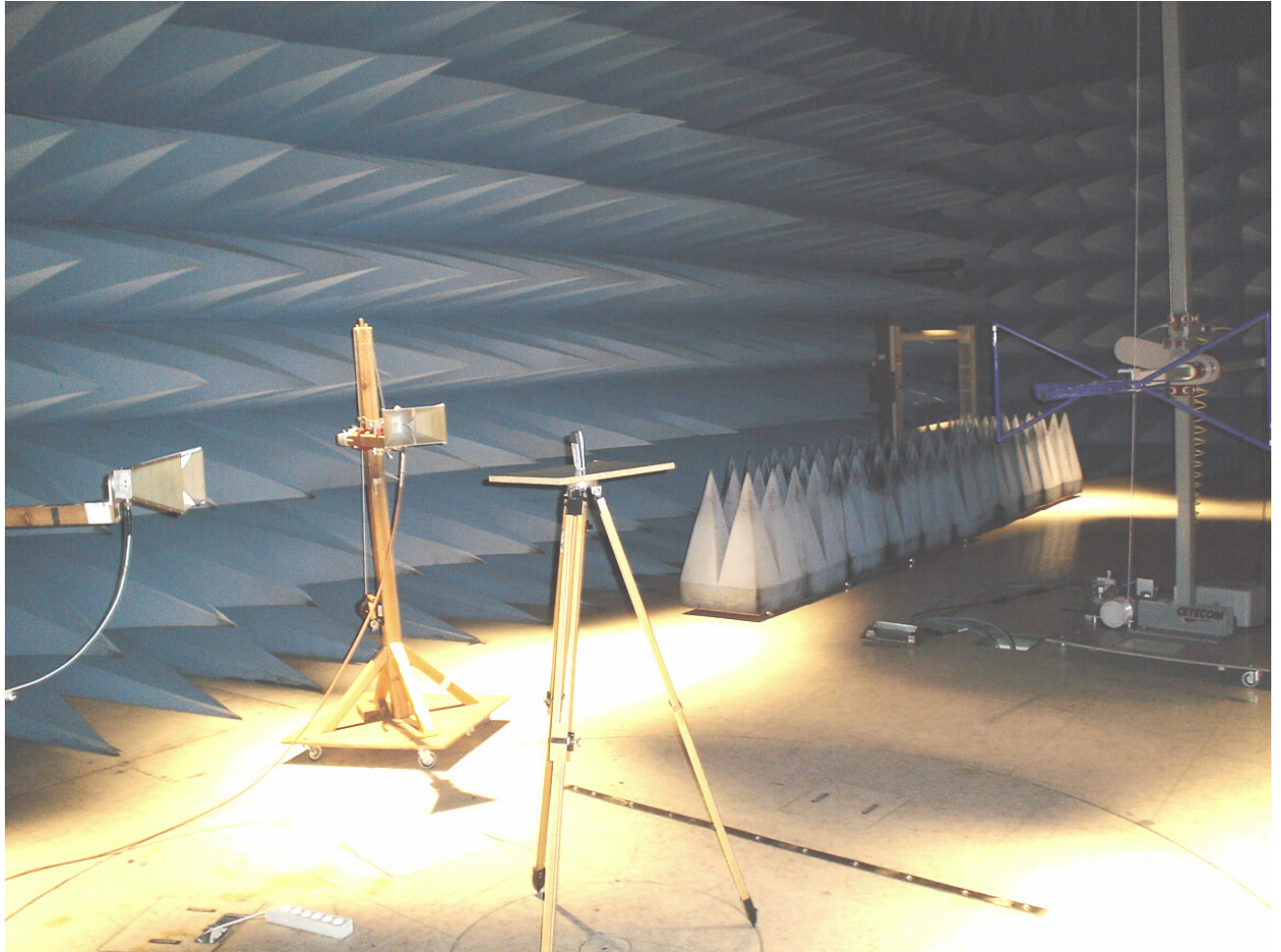
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Annex E

3. General test set-up for radiated measurements.



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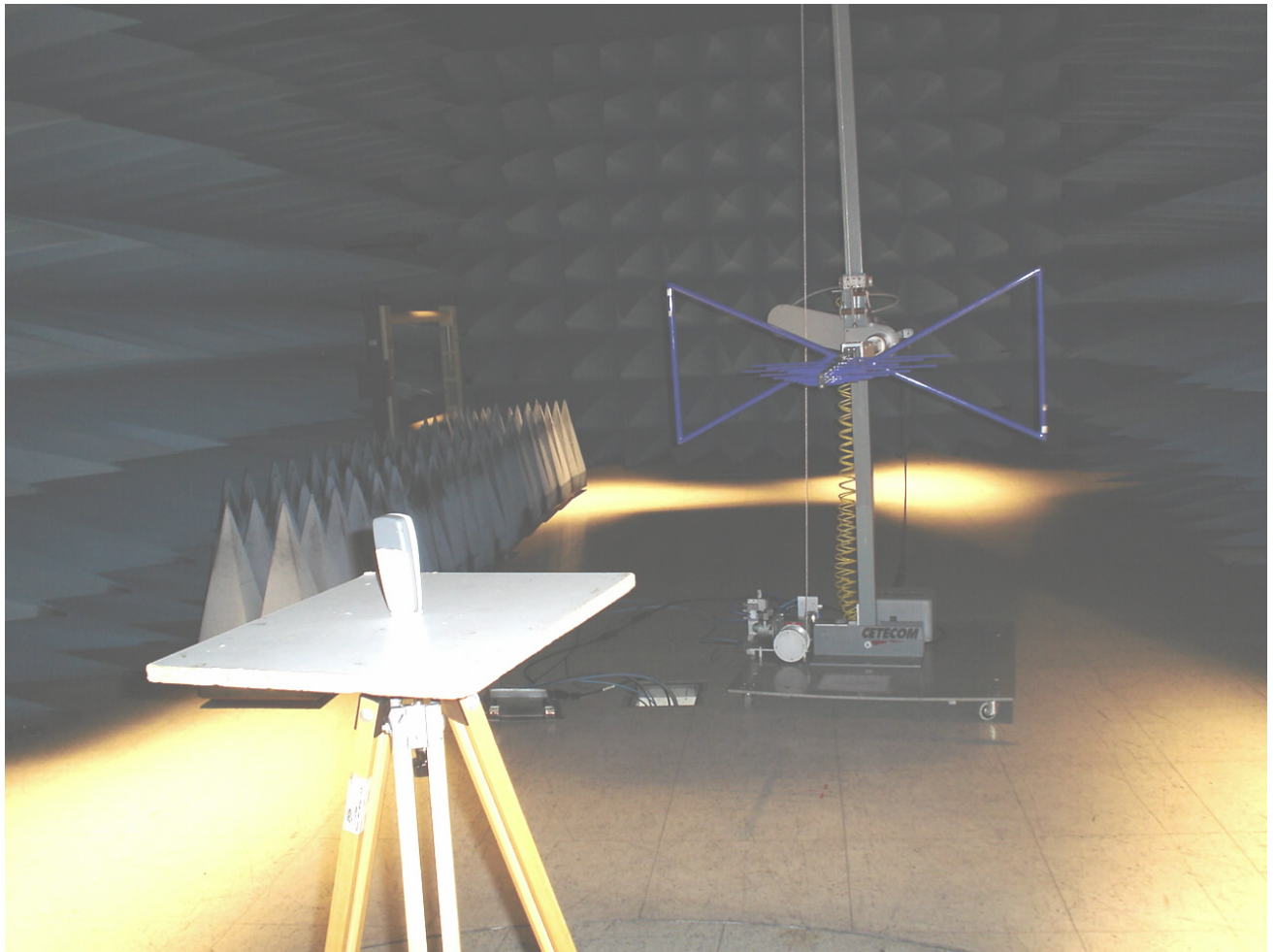
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4. Test set-up for radiated measurements below 1 GHz.



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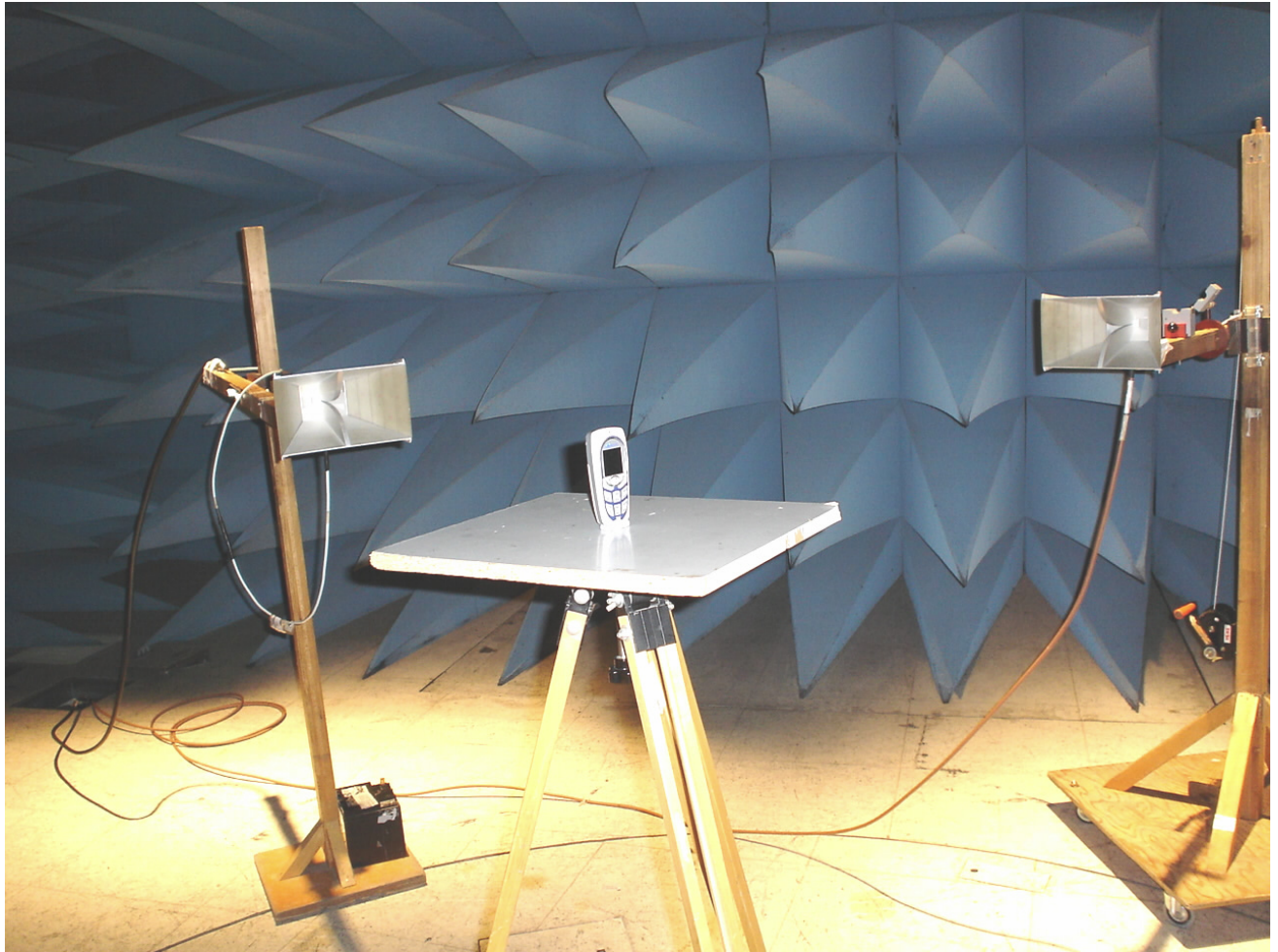
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Annex E

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



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