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Sede operativa : Laboratori Via Campagna, 92 22020 Faloppio fraz. Gaggino (CO) Tel. +39 03135000.11 Fax +39 031991309

EQUIPMENT UNDER TEST : **GPS/GPRS**
APPARECCHIO IN PROVA : **MODEL: CONNECT**

REFERENCE STANDARDS: **FCC RULES PART 22 and 24**
NORME DI RIFERIMENTO :

Customer:

RICHIEDENTE:

- **Dept. / Firm :** GPS-BUDDY LTD
  Ente / Società':
- **Mr.:** ROBERT HOUBOURDIN
  Sig.:
- **Address:** 4, LAPPS QUAY – CORK IRELAND
  Indirizzo:

- **Tel.** : +35 33232015656 *Telefono :*
- **Telefax:** +35 33232015655 *Fax :*
- **E-mail:** robert@gps-buddy.com

Site of test execution: Via Campagna, 92 - 22020 Gaggino Faloppio (CO) - Italy
Località esecuzione prove:

Date of test samples receipt: **18/10/2007**
Data ricevimento campioni:

Date of start test: **18/10/2007**
Data inizio prove:

Date of end test: **10/09/2008**
Data fine prove:

Witness to the test:	**Signature of the engineers:**	**Signature of the Laboratory Director:**
Presenti alle prove:	Firma esecutore prove:	Firma Direttore Laboratori:
Nobody / Nessuno	Massimo Maltempi	Giovanni Molteni

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0. CONTENTS

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1. TECHNICAL INFORMATION OF EQUIPMENT UNDER TEST (EUT)

1.1 Identification

Brand name:	GPS BUDDY LTD
Manufacturer:	JECKO
Equipment :	GPS / GPRS Module
Model name :	CONNECT
Country of manufacturer:	ITALY

1.2 Technical data

FCC class:	FCC RULES PART 22 and 24
FCC ID:	-
Supply voltage:	12/24 Vdc
EUT standing:	Car power supply socket
EUT single or system:	Single
EUT dimensions :	173 x 47 x 25 mm

GSM module manufacturer	Telit
Module type :	GE863 – QUAD

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Type of antenna :	☒ Integral ; ☐ External ; ☐ Dedicated
Frequency range TX - GSM 850	824.2 – 848.80 MHz
Frequency range TX - PCS	1850.2 – 1909.8 MHz
Frequency range RX – GSM 850	869.2 – 893.8 MHz
Frequency range RX – PCS	1930.2 – 1989.8 MHz
Antenna gain	-2,1 dBi
Power supply	3,7 V
Operating mode	Duplex
Type of modulation	GMSK (GSM modulation)
Emission	GXW
Software	Fully GSM software Stack
Temperature range	Operating: -30°C to +55°C Storage: -30°C to +85°C

1.3 Modifications incorporated in E.U.T.

The following items are the modifications introduced in the equipment under test :

- None

1.4 Ports identification

This section contains descriptions of all signal ports and AC/DC power input/output ports, the length and the type of the cable provided by manufacturer needed for the tests.

Moreover it is specified if the ports are ever or optionally connected.

Port		*Description*	*Connection*
1	Enclosure	*PLASTIC*	*CLIPS*
2	AC power input/output ports	NOT PRESENT	CONNECTOR
3	DC power input/output ports	12/24 from vehicle battery	----------
4	Signals ports	Serial port	Connector
5	Signals ports	USB	Mini USB Connector
Note: During the tests all cables must be what provided the manufacturer or the same that used in the real employment of the EUT.			

1.5 Auxiliary equipment

No auxiliary equipment

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2. TEST CONDITIONS

2.1 Operating test modes and test conditions

The equipment has been tested according to the operative conditions described in the user/installation manual provided by the manufacturer and by following reference standards :

Reference Standard:

FCC Part 22, 24, 2

In the following table there are the operating conditions adopted during tests identified by an indicator (#..) at which has been referred the item “Operating condition of the equipment under test” of all technical sheets of the tests (see Section 4)

Operating condition	*Description*
#1	*Continuous transmissionat 850 frequency band*
#2	*Continuous transmissionat 1900 frequency band*

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3. Summary of test results

3.1 Tests

Name of test	Paragraph	Result
RF Power Output	2.1046	Test passed
ERP, EIRP	22.913; 24.232	Test passed
Occupied Bandwidth	22.917(b)(d), 24.238, 2.1049	Test passed
Field Strength of Spurious Radiation	2.1053	Test passed

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4. TEST RESULTS

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TEST 1.

RF POWER OUTPUT

REFERENCE DOCUMENT

FCC 2.1046 Measurements required: RF power output.
Power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on circuit elements as specified. The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.

FCC 22.913

The Effective Radiated Power (ERP) of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

FCC 24.232

The equivalent Isotropic Radiated Power (EIRP) must not exceed 2 Watts.

2.1 Test procedure

The EUT was positioned on a non-conductive turntable, 0.8m above the ground plane on Semianechoic chamber. The radiated emission at the fundamental frequency was measured at 3m distance with a test antenna and spectrum analyzer. Worst case emission was recorded with the rotation of the turntable and the raising and lowering of the test antenna. ERP in frequency band 824.2-848.8 MHz, and EIRP in frequency band 1850.2-1909.8 MHz were measured using a substitution method. The EUT was replaced by half-wave dipole (824.2-848.8 MHz) or horn antenna (1850.2-1909.8 MHz) connected to a signal generator.

2.1.1 Substitution RF power measurement:

The applied substitution method follows ANSI/TIA/EIA-603, ANSI/TIA/EIA-102.CAAA or the appropriate ETSI rules respectively. The actual signal generated by the EUT can be determined by means of a substitution measurement in which a known signal source replaces the device to be measured.
The substitution antenna replaces the transmitter antenna at the same position and in vertical polarisation. The frequency of the signal generator shall be adjusted to the measurement frequency. The test antenna shall be raised or lowered, if necessary, to ensure that the maximum signal is still received. The input signal to the substitution antenna shall be adjusted in level until an equal or a known related level to that detected from the transmitter is obtained in the measurement receiver. If a fully anechoic chamber is used as test site in order to provide free space conditions there is no need to change the height of the antenna. The measurement will be repeated in horizontal position.
In order to make this kind of measurement more effective and to avoid subjective measurement faults ETS has installed automatic computer controlled measurement procedures. With the above described substitution method a test site is calibrated over the full frequency range which is used in suitable frequency steps. For a certain power level on the substitution antenna the received power over the whole frequency range is documented. All necessary antenna gains, cable losses, filter losses and amplifications of preamplifiers are taken in consideration. The summary of this calibration measurement performs a transducer factor that is related to the considered test site and a certain measurement distance. Differences of the radiated power levels of different test samples are determined by internal attenuation of the measurement receiver. The proper function of such test site will be maintained by short term plausibility checks and periodical re-calibration. Now the test sample will be putted on the table at the defined position and the radiated power will be received and documented by the measurement receiver. On test sites with ground plane the measurement antenna will be lowered and raised to maximum values at significant frequencies. For peak power measurements the sample is turned by the turntable over 360 degree in order to find the direction with the maximum radiation or to document the max reading with the MAXHOLD function during the rotation.

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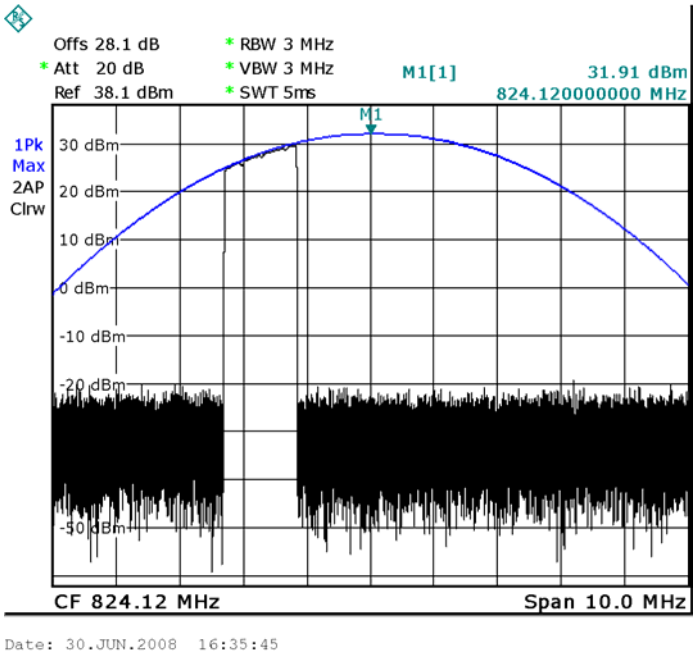
2.2 Test Result

GSM 850	Power Control Level = 5	
Channel	Frequency (MHz)	ERP Output Power(dBm)
128	824,12	31.91
188	836,58	30.99
251	848,798	31.29



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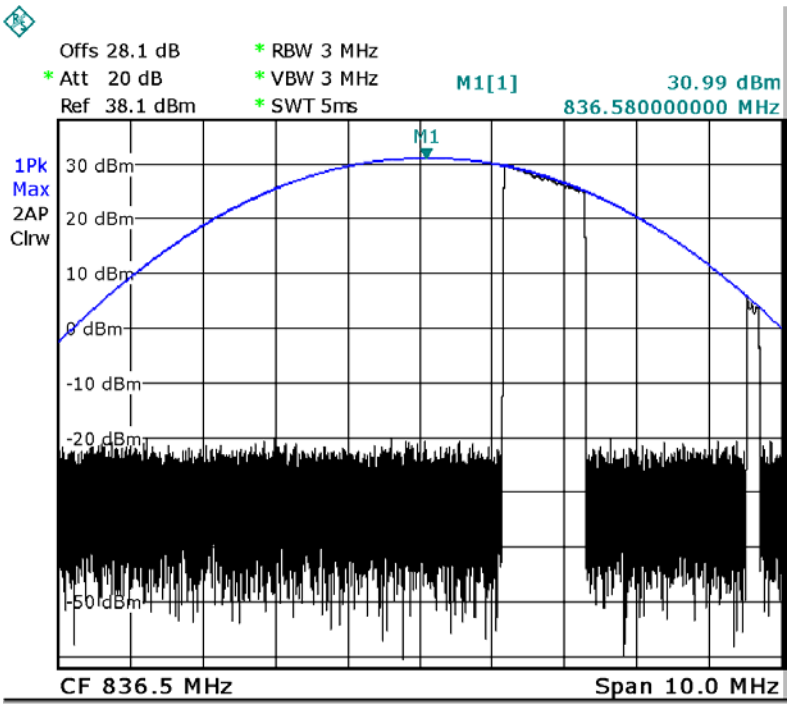

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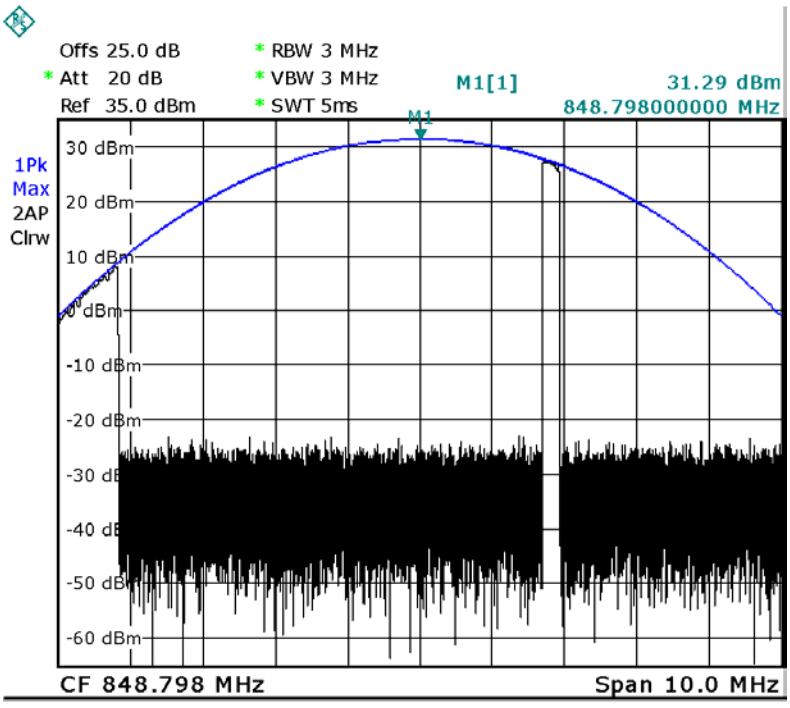

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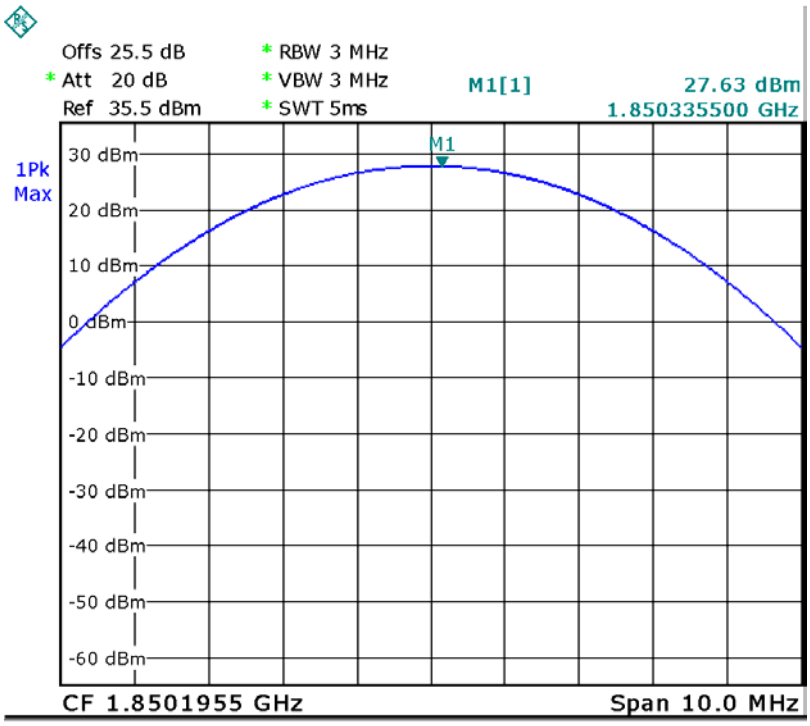
PCS 1900	Power Control Level = 0	
Channel	Frequency (MHz)	EIRP Output Power(dBm)
512	1850,335	27.63
661	1880,24	26.58
810	1909,738	25,72



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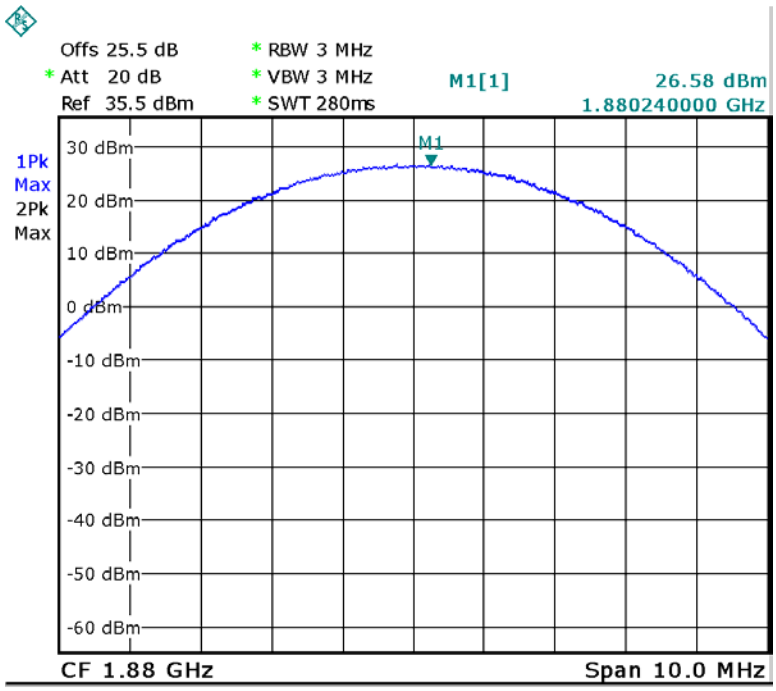

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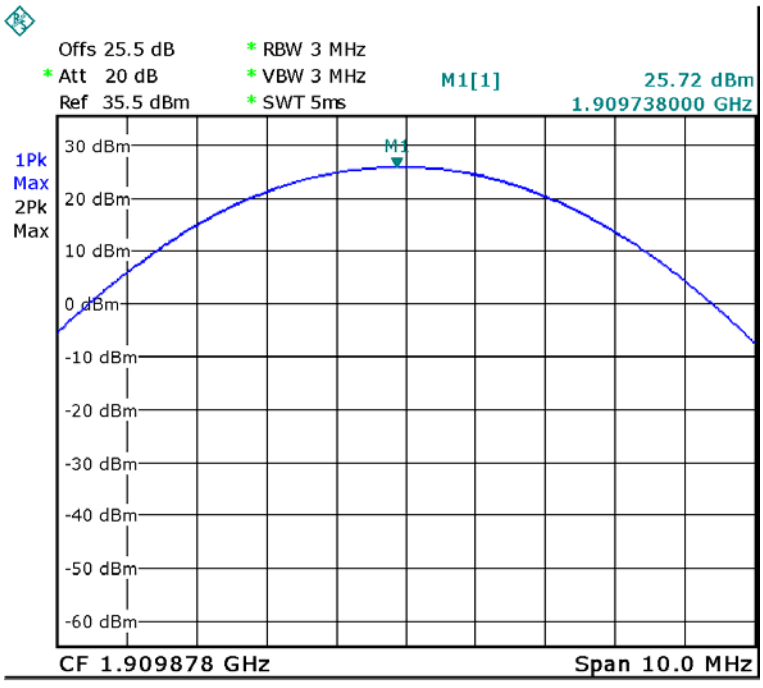

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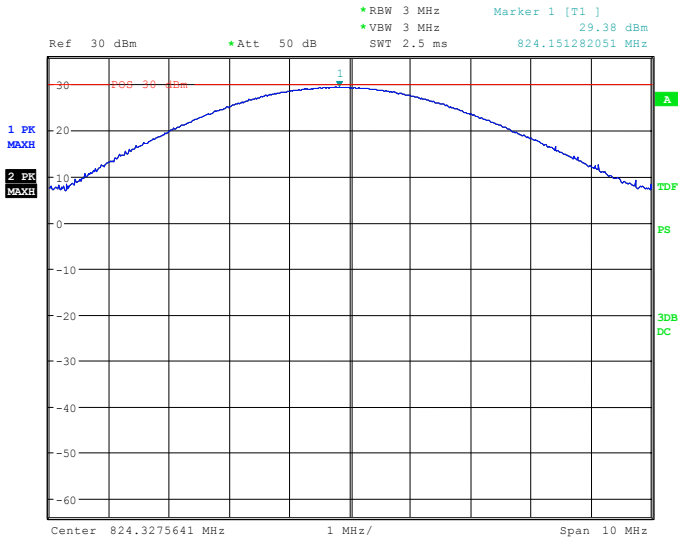
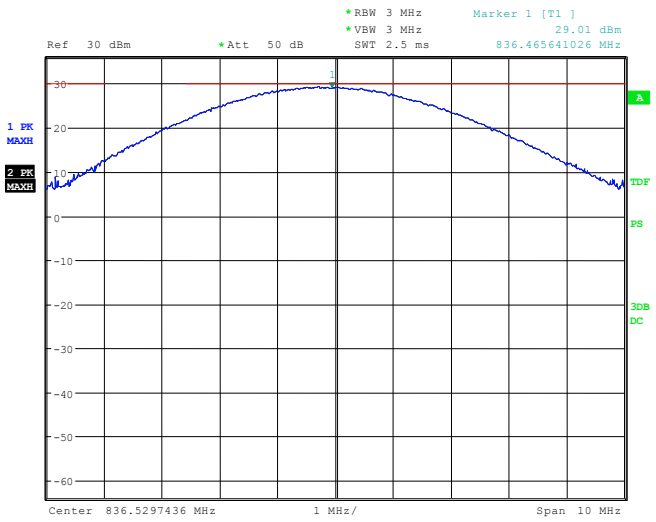
Conducted measurement

GSM 850	Power Control Level = 5	
Channel	Frequency (MHz)	ERP Output Power(dBm)
128	824,15	29.38
188	836,58	30.99
251	848,798	29.37

Ch128



ch188



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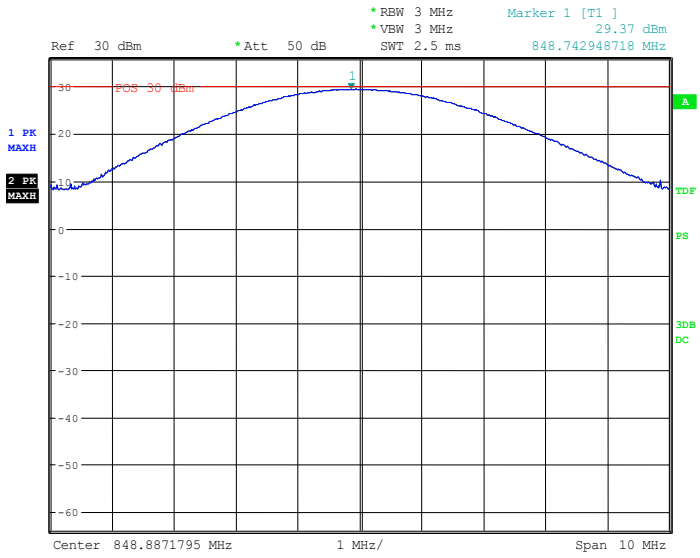
ch251



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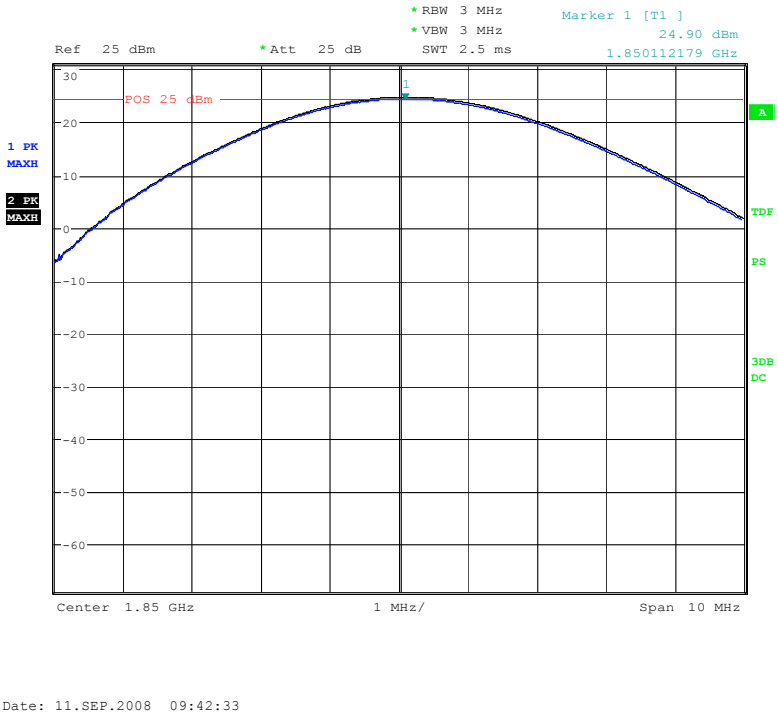
PCS 1900

Channel	Frequency (MHz)	EIRP Output Power(dBm)
512	1850,112	24.90
661	1879,96	25.11
810	1909,807	24,84

CH512



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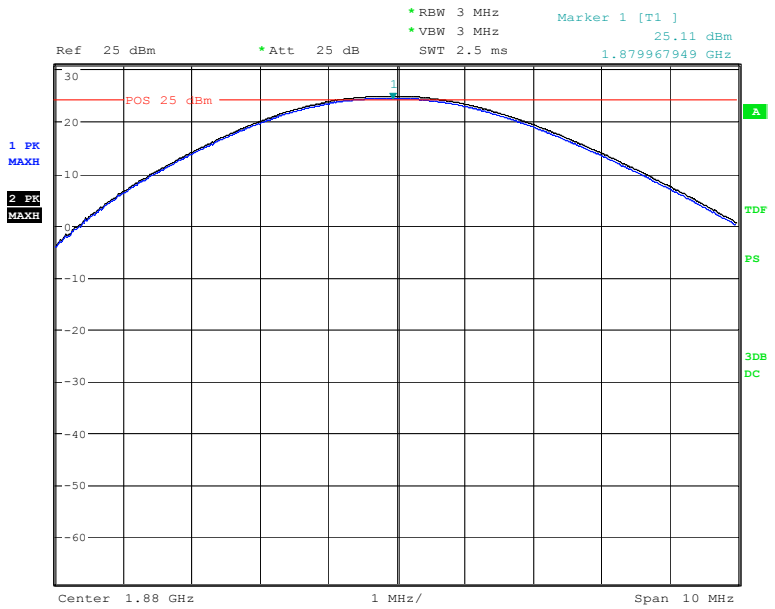
Ch661



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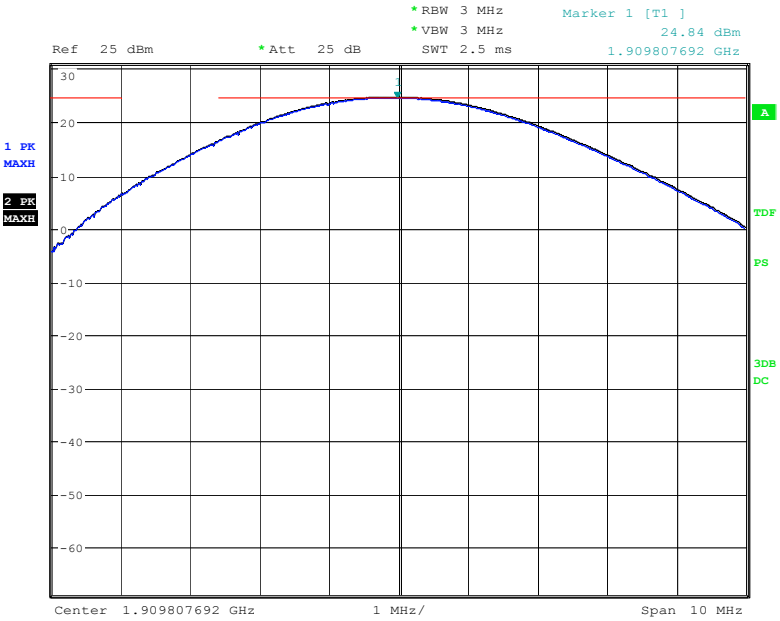
Ch810



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TEST 2.

OCCUPIED BANDWIDTH

REFERENCE DOCUMENT

FCC Part. 22.917 (b)(d) ; FCC Part 24.238, FCC. 2.1049

3.1 General

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

3.2 Test procedure

Adjust the settings of the Digital Radiocommunication Tester (DRT) to set the EUT to its maximum power at the required channel
The RF output of the transceiver was connected to the input of the spectrum analyzer through sufficient attenuation.
Set the spectrum analyzer to measure the 99% (-20 dB) occupied bandwidth. Record the value
Set the spectrum analyzer to measure the 99.5% (-26 dB) emission bandwidth. Record the value..
Measurements are to be performed with the EUT set to the low, middle and high channel of each frequency band

3.3 Test results

GSM 850

Channel	Occupied Channel Bandwidth –20dB (kHz)	Emission Bandwidth –26dB (kHz)
128	265,5	321,4
188	281,4	311,4
251	263,5	315,4

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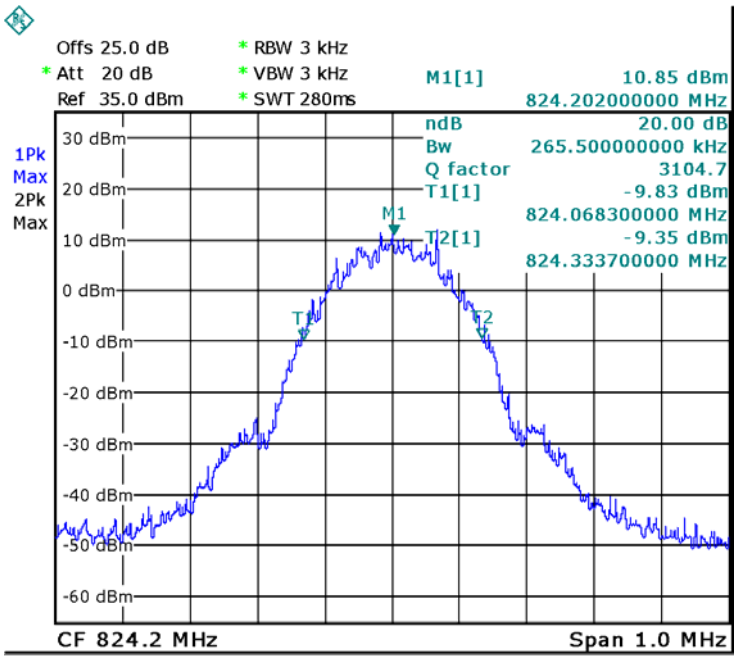

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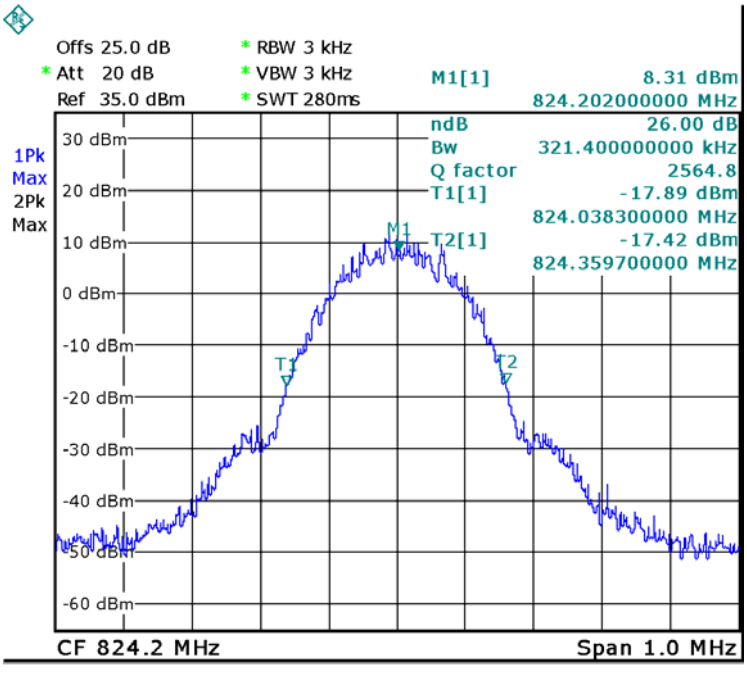

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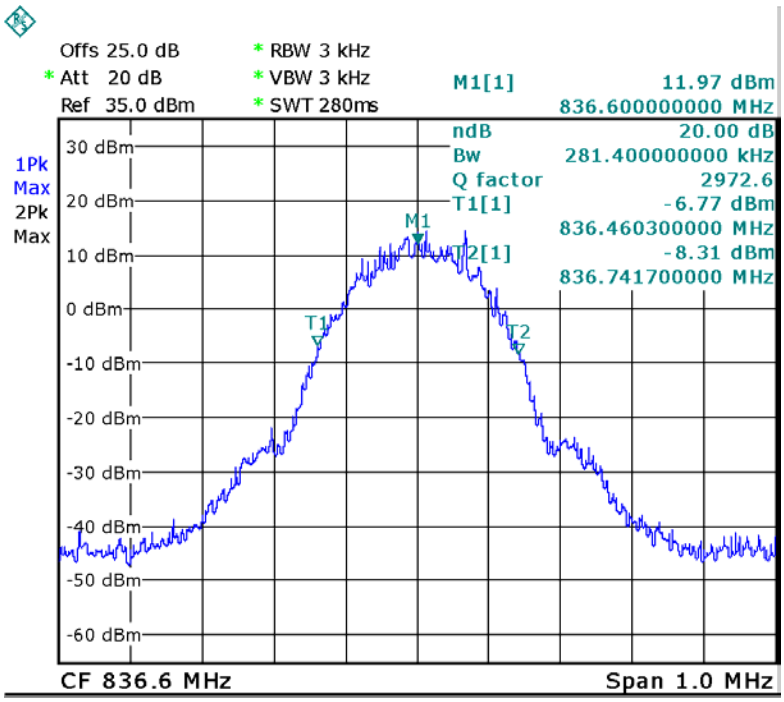

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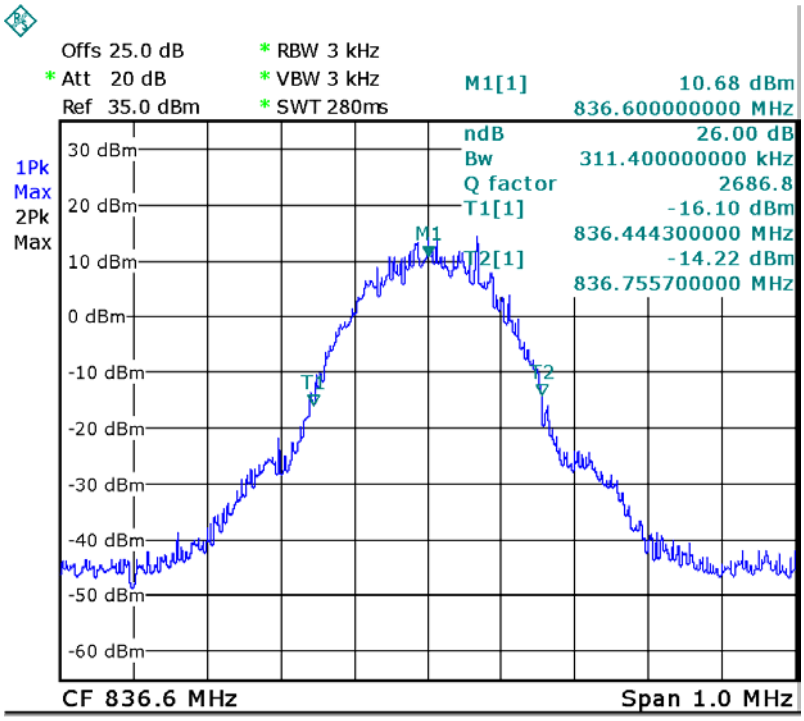

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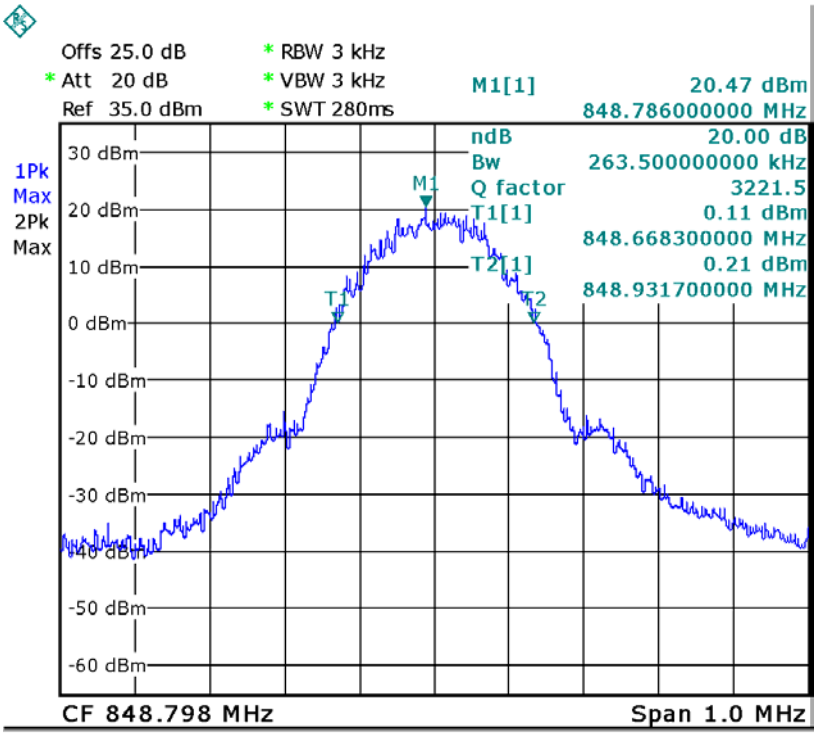

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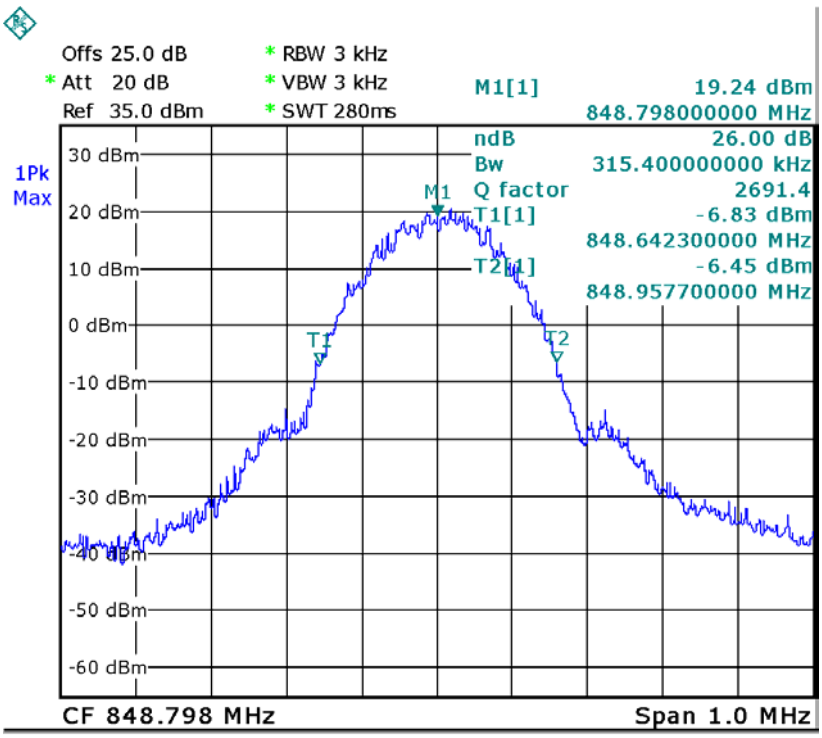

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PCS 1900

Channel	Occupied Channel Bandwidth (kHz)	Emission Bandwidth (kHz)
512	263,5	315,4
661	259,5	315,4
810	271,5	305,4

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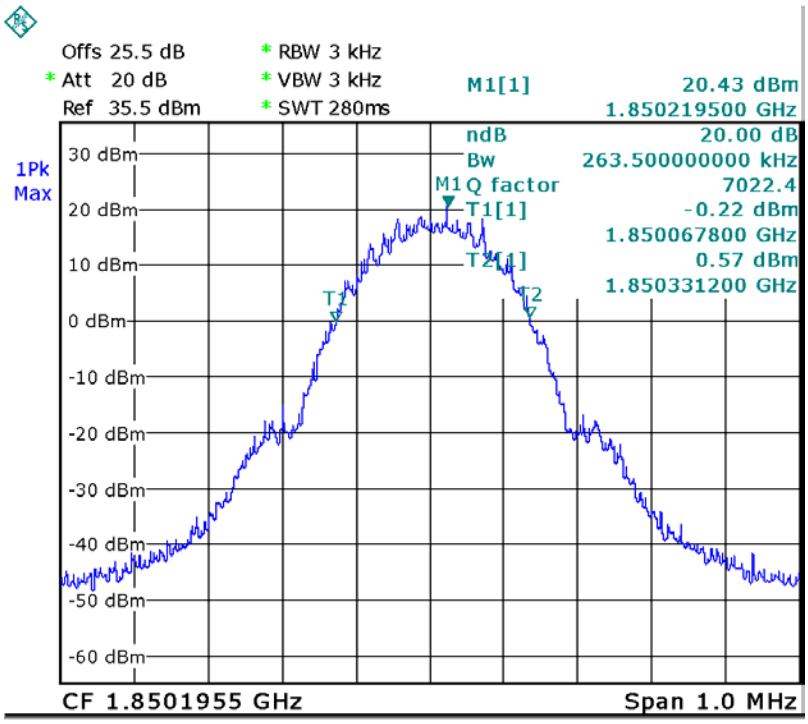
Sede operativa : Laboratori Via Campagna, 92 22020 Faloppio fraz. Gaggino (CO) Tel. +39 03135000.11 Fax +39 031991309



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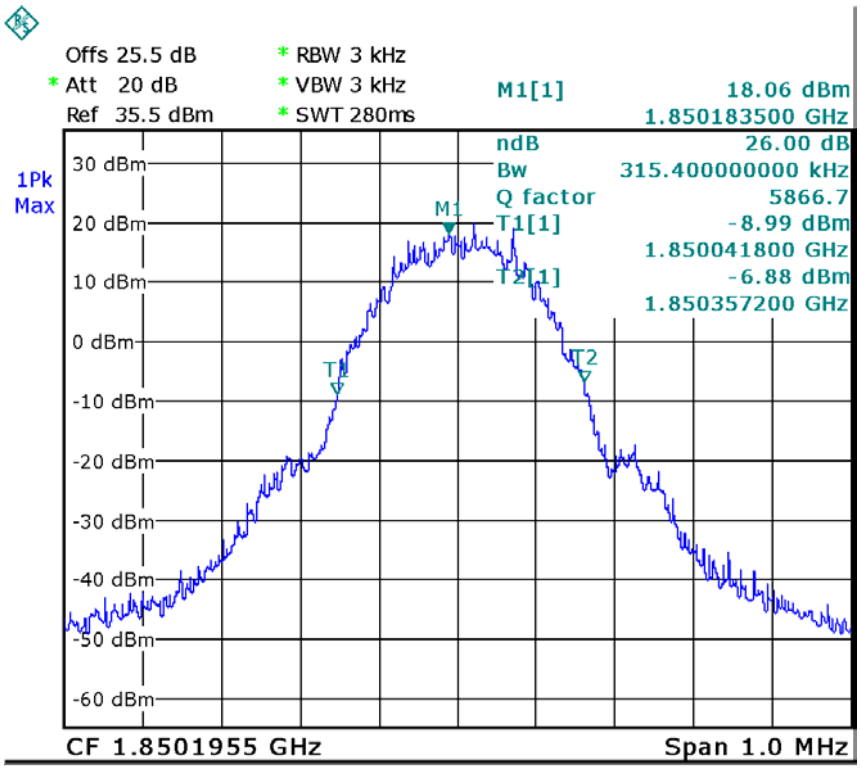

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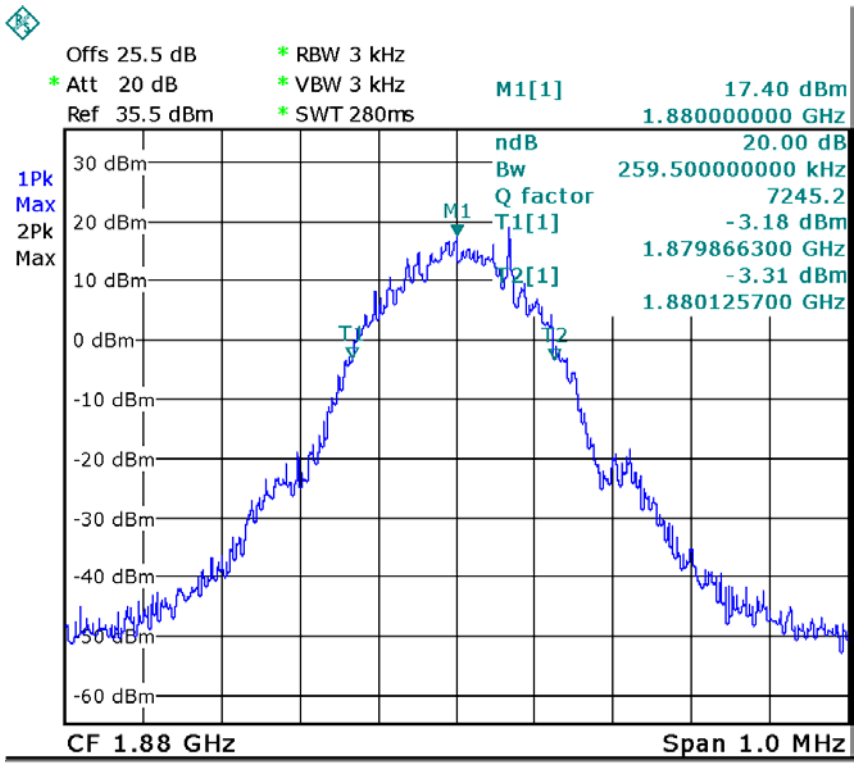

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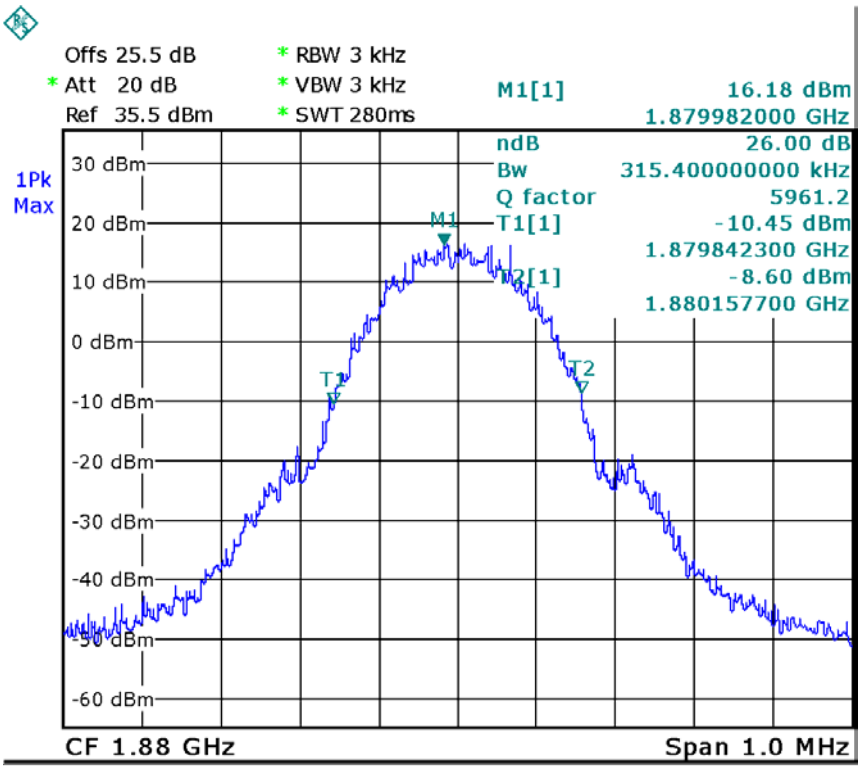

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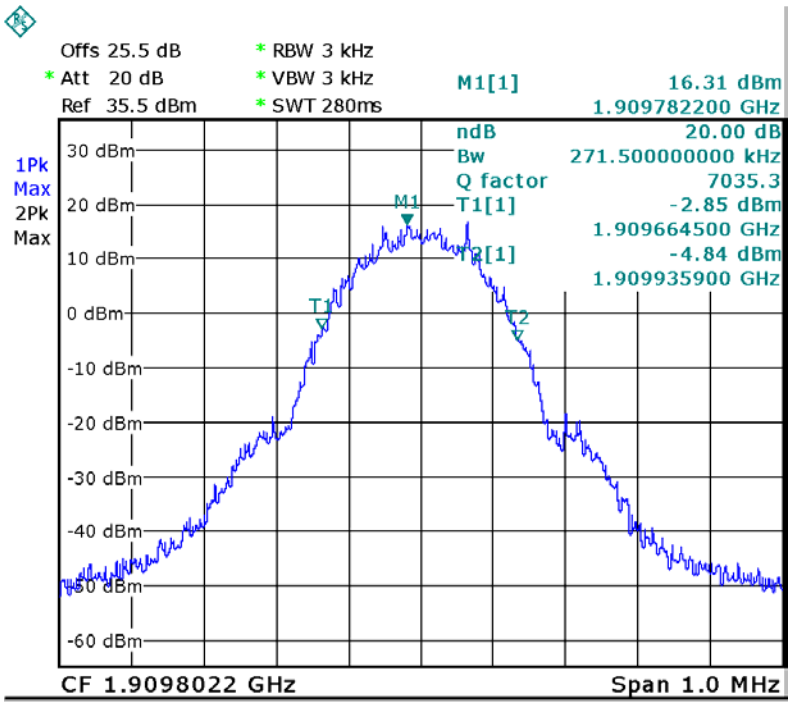

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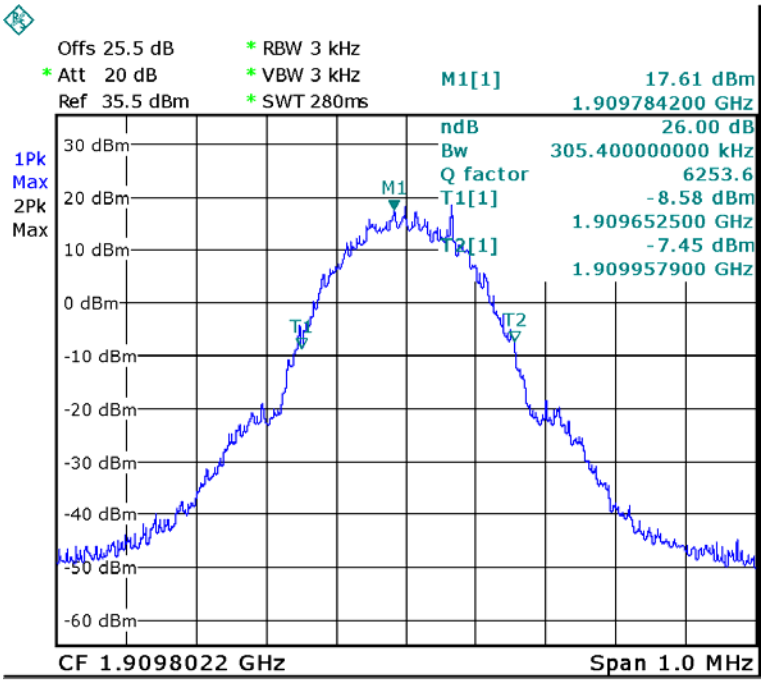

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TEST 3.

FREQUENCY STABILITY

REFERENCE DOCUMENT FCC Part. 24.235, "Hand carried, battery powered equipment" Section 2.1055(d)(2) applies

This transceiver is specified to operate with an input voltage of between 3.2VDC and 4.5VDC, with a nominal voltage of 3.7VDC.

FREQUENCY STABILITY (GSM-850) ch188 836,58MHz

FREQ ERROR VS. VOLTAGE

Voltage (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
10	**-11**	0,013149
13,5	**-21**	0,025102

FREQ ERROR vs. TEMPERATURE

TEMPERATURE (°C)	Frequency Error (Hz)	Frequency Error (ppm)
-30	**-31**	0,037056
-20	**-15**	0,01793
-10	**-13**	0,01554
0	**-12**	0,01434
+10	**-6**	0,00717
+20	**-2**	0,00239
+30	**10**	0,011953
+40	**-10**	0,011953
+50	**11**	0,013149

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FREQUENCY STABILITY (PCS-1900) 661 1880,24

FREQ ERROR VS. VOLTAGE

Voltage (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
10	**-14**	0,007446
13,5	**-17**	0,009041

FREQ ERROR vs. TEMPERATURE

TEMPERATURE (°C)	Frequency Error (Hz)	Frequency Error (ppm)
-30	**-21**	0,011169
-20	**-12**	0,006382
-10	**-12**	0,006382
0	**-10**	0,005318
+10	**-9**	0,004787
+20	**-10**	0,005318
+30	**12**	0,006382
+40	**15**	0,007978
+50	**17**	0,009041

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TEST 4.

FIELD STRENGTH OF SPURIOUS RADIATION

REFERENCE DOCUMENT

FCC Part. 2.1053

5.1 Test procedure

The EUT was positioned on a non-conductive turntable, 0.8m above the ground plane. The radiated emission at the fundamental frequency was measured at 3m distance with a test antenna and spectrum analyzer. Worst case emission was recorded with the rotation of the turntable and the raising and lowering of the test antenna. ERP was measured using a substitution method. The EUT was replaced by horn antenna connected to a signal generator. The frequency range up to tenth harmonic was investigated.

5.2 Test results

The radiated spurious emissions were measured for channel 128, channel 188 and channel 251, respectively the upper, center, and lower frequencies of the US GSM band (824,2MHz, 836,5MHz and 848,8 MHz). The measurement diagrams show that all significant spurs are well below the limit line. The measurements of the spurious emissions at the equipment output terminals were performed pursuant to § 2.1053 in order to verify that any emissions are below the limits given by § 24.238.

GSM 850 (Channel 128)

Frequency (MHz)	Level (dBm)	Polarization	BW MHz	Limit (dBm)	Result
38.88	-58.28	Vertical	0,1	-13	-45.28
212.240	-57.6	Horizontal	0,1	-13	-44.6
720.000	-53.08	Horizontal	0,1	-13	-40.08
1648.200	-44.83	Vertical	1	-13	-30.83
3296.400	-42.62	Vertical	1	-13	-29.62
3590.900	-37.15	Horizontal	1	-13	-24.15
5768.700	-47.2	Vertical	1	-13	-34.2
8500.000	--	--	1	-13	--

Spuroius frequency found below 1 GHz are component of electronics circuit other than GSM/PCS module: we found the same on all radiated measurement
Frequency at 3590 MHz is spurious other than harmonics components of carrier frequency: we found the same on all radiated and conducted measurement

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GSM 850 (Channel 188)

Frequency (MHz)	Level (dBm)	Polarization	BW MHz	Limit (dBm)	Result
38.88	-58.28	Vertical	0,1	-13	-45.28
212.240	-57.6	Horizontal	0,1	-13	-44.6
720.000	-53.08	Horizontal	0,1	-13	-40.08
1673.600	-43.05	Vertical	1	-13	-30.05
3590.900	-37.15	Horizontal	1	-13	-24.15
5857.600	-45.95	Vertical	1	-13	-32.95
8500.000	--	--	1	-13	---

GSM 850 (Channel 251)

Frequency (MHz)	Level (dBm)	Polarization	BW MHz	Limit (dBm)	Result
38.88	-58.28	Vertical	0,1	-13	-45.28
212.240	-57.6	Horizontal	0,1	-13	-44.6
720.000	-53.08	Horizontal	0,1	-13	-40.08
1697.580	-46.6	Vertical	1	-13	-33.6
3590.900	-37.15	Horizontal	1	-13	-24.15
5941.50	-48.7	Vertical	1	-13	-35.7
8500.000	--	--	1	-13	---

Spuroius frequency found below 1 GHz are component of electronics circuit other than GSM/PCS module: we found the same on all radiated measurement

Frequency at 3590 MHz is spurious other than harmonics components of carrier frequency: we found the same on all radiated measurement

Prima Ricerca & Sviluppo Srl soggetta a direzione e coordinamento da parte della Giovanni Maspero & C. S.p.A. – C.I. 02634780130
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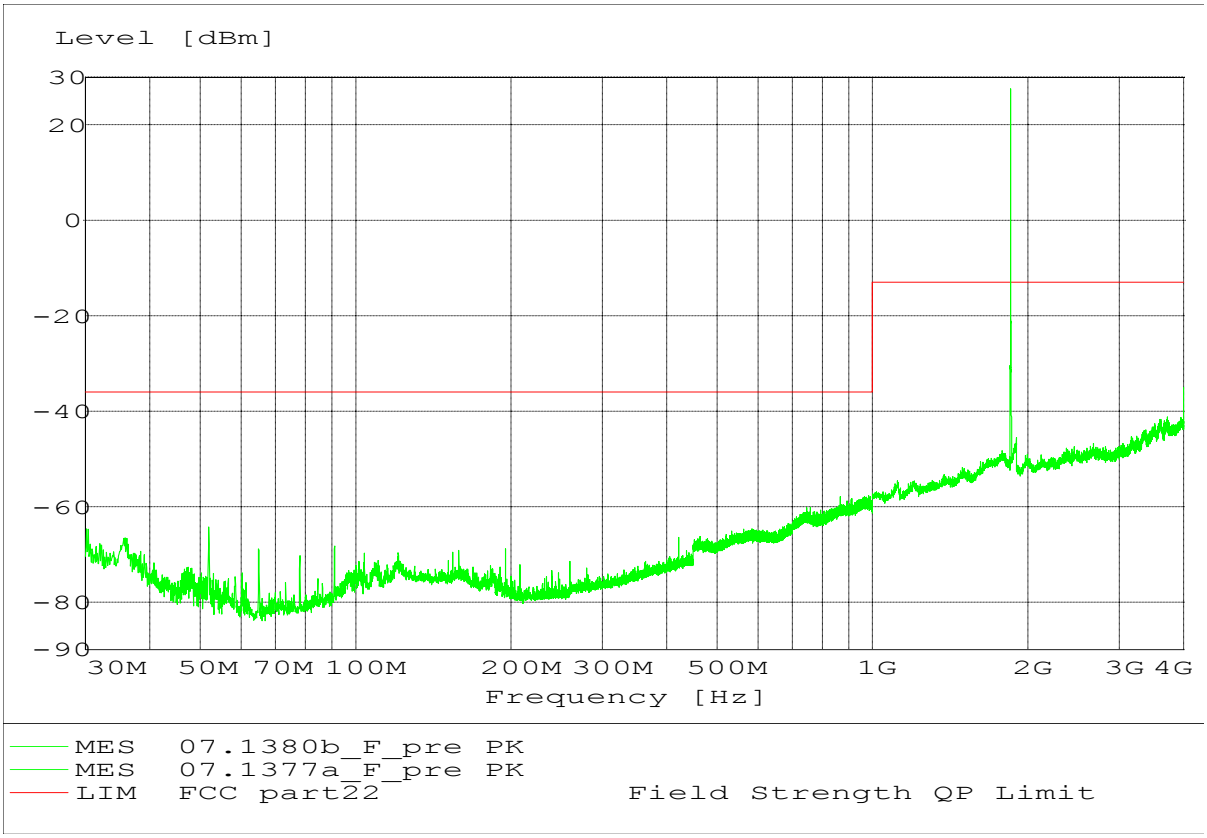
PCS 1900

The radiated spurious emissions were measured for channel 512, channel 661 and channel 810, respectively the upper, center, and lower frequencies of the US PCS band (1850.2 MHz, 1880.0 MHz and 1909.8 MHz). The measurement show that all significant spurs are well below the limit line. The measurements of the spurious emissions at the equipment output terminals were performed pursuant to § 2.1053 in order to verify that any emissions are below the limits given by § 24.238.

PCS 1900 (Channel 512)

Frequency (MHz)	Level (dBm)	BW MHz	Polarization	Limit (dBm)	Result
52.7	-62.17	0,1	Vertical	-13	-49.17
4000.000	Noise floor	1	---	-13	--
20000.000	Noise floor	1	---	-13	--



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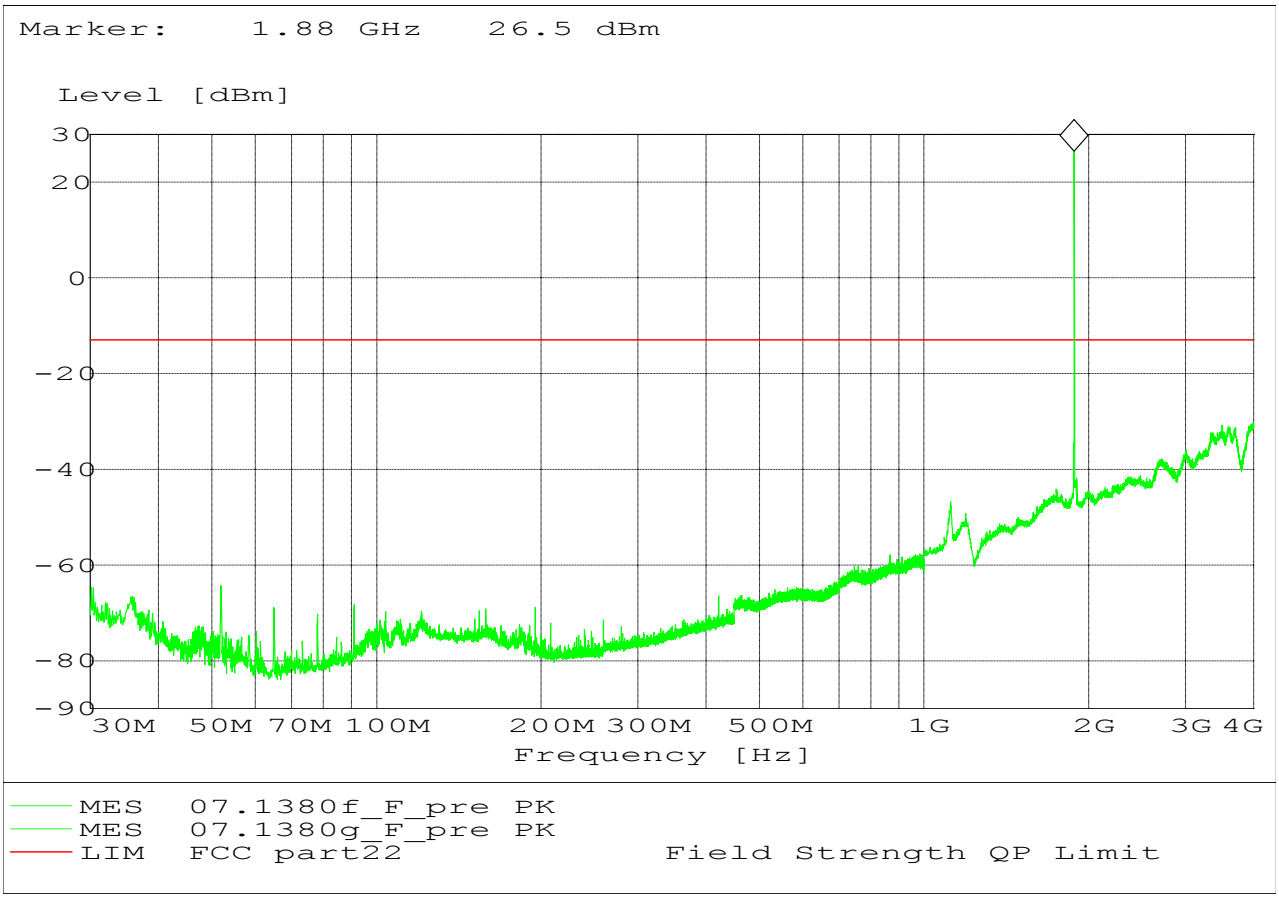
PCS 1900 (Channel 661)

Frequency (MHz)	Level (dBm)	BW MHz	Polarization	Limit (dBm)	Result
52.7	-62.17	0,1	Vertical	-13	-49.17
4000.000	Noise floor	1	---	-13	--
20000.000	Noise floor	1	---	-13	--



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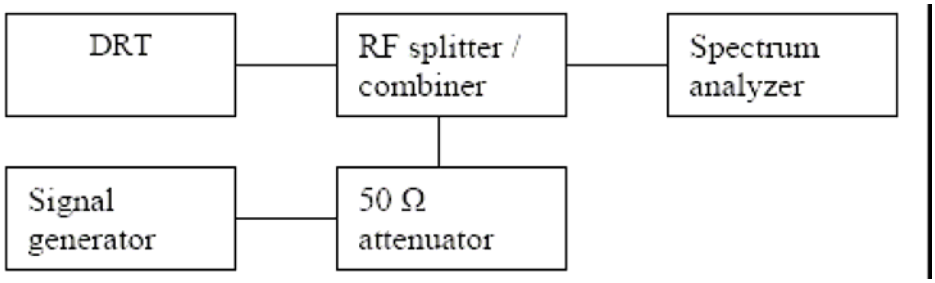
TEST 5.

CONDUCTED SPURIOUS EMISSION

REFERENCE DOCUMENT RSS-133, Issue 3, Section 4.4
RSS-132, Issue 2 Section 4.5

FCC 2.1051 Measurements required: Spurious emissions at antenna terminals.
The radio frequency voltage or power generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in FCC 2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

5.2 Test procedure



Connect the equipment as shown in the above diagram.
Set the spectrum analyzer to measure peak hold with the required settings. Set the signal generator to a known output power and record the path loss in dB (**LOSS)** for frequencies up to the tenth harmonic of the EUT's carrier frequency. **LOSS** = Generator Output Power (dBm) – Analyzer reading (dBm).
Replace the signal generator with the EUT. Adjust the settings of the Digital Radiocommunication Tester (DRT) to set the EUT to its maximum power at the required channel.
Set the spectrum analyzer to measure peak hold with the required settings. Offset the spectrum analyzer reference level by the path loss measured above.

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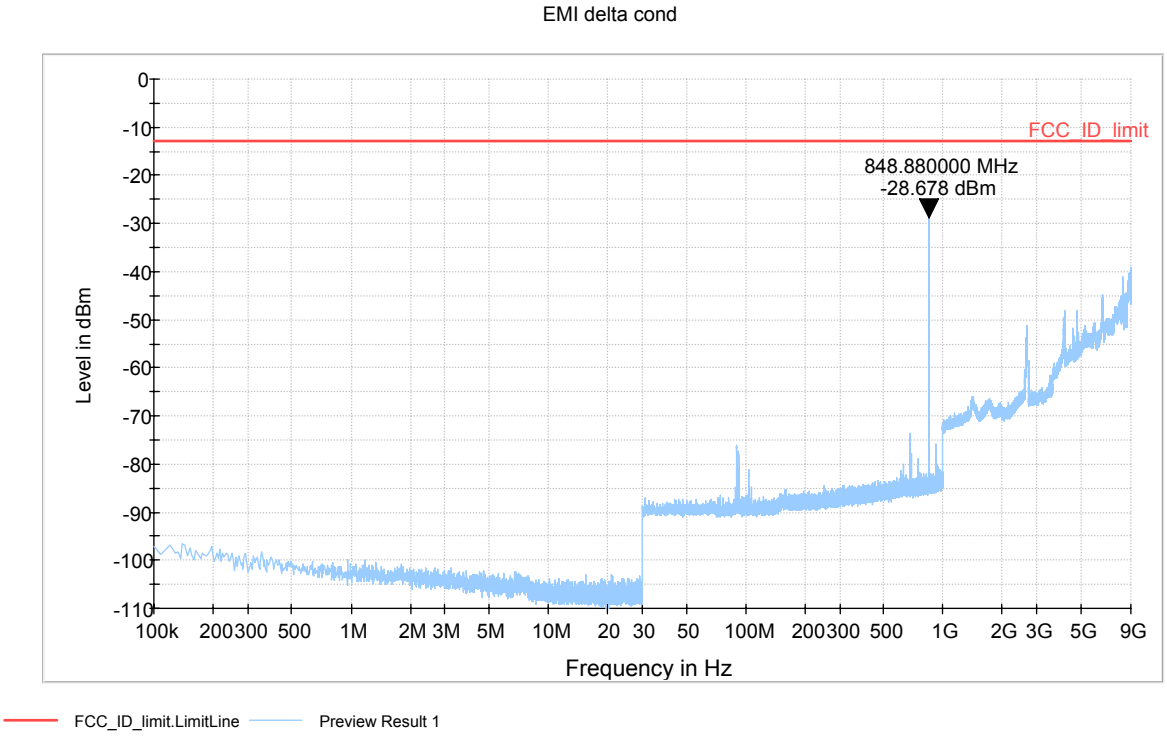
5.2 Test results

GSM 850 (Channel 128)

The conducted spurious emissions were measured for channel 128 and channel 251, respectively the upper, center, and lower frequencies of the US GSM band (824,2MHz, 836,5MHz and 848,8 MHz). The measurement diagrams show that all significant spurs are well below the limit line. The measurements of the spurious emissions at the equipment output terminals were performed pursuant to § 2.1053 in order to verify that any emissions are below the limits given by § 24.238.

band	Resolution bandwidth
100KHz - 30MHz	10 KHz
30MHz - 1000MHz	100 KHz
1GHz – 9GHz	1000 KHz



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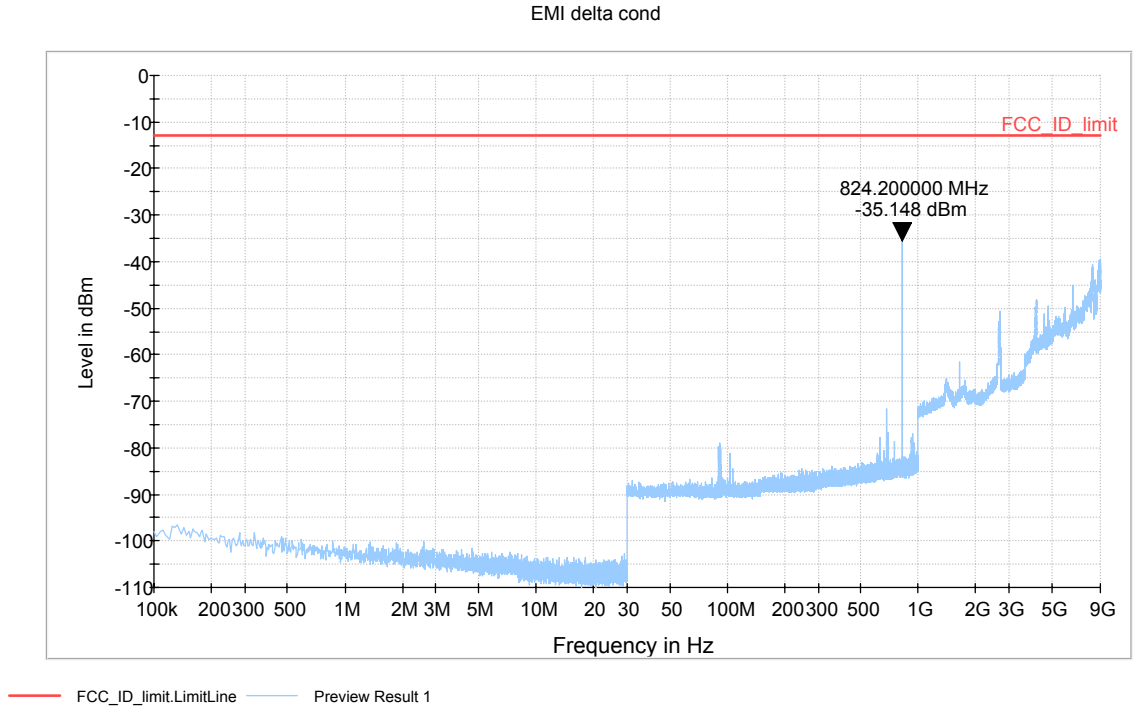
band	Resolution bandwidth
100KHz - 30MHz	10 KHz
30MHz - 1000MHz	100 KHz
1GHz – 9GHz	1000 KHz



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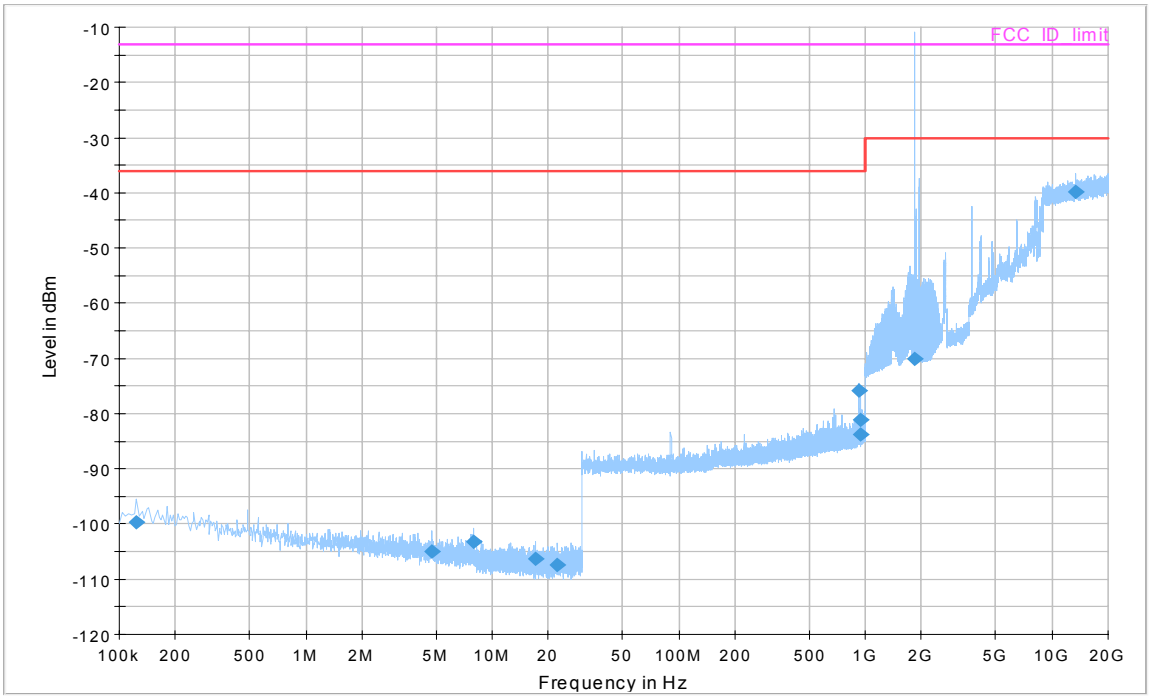
PCS 1900

The conducted spurious emissions were measured for channel 512, channel 661, of the US PCS band. The measurement show that all significant spurs are well below the limit line. The measurements of the spurious emissions at the equipment output terminals were performed pursuant to § 2.1053 in order to verify that any emissions are below the limits given by § 24.238.

band	Resolution bandwidth
100KHz - 30MHz	10 KHz
30MHz - 1000MHz	100 KHz
1GHz – 9GHz	1000 KHz

channel 512



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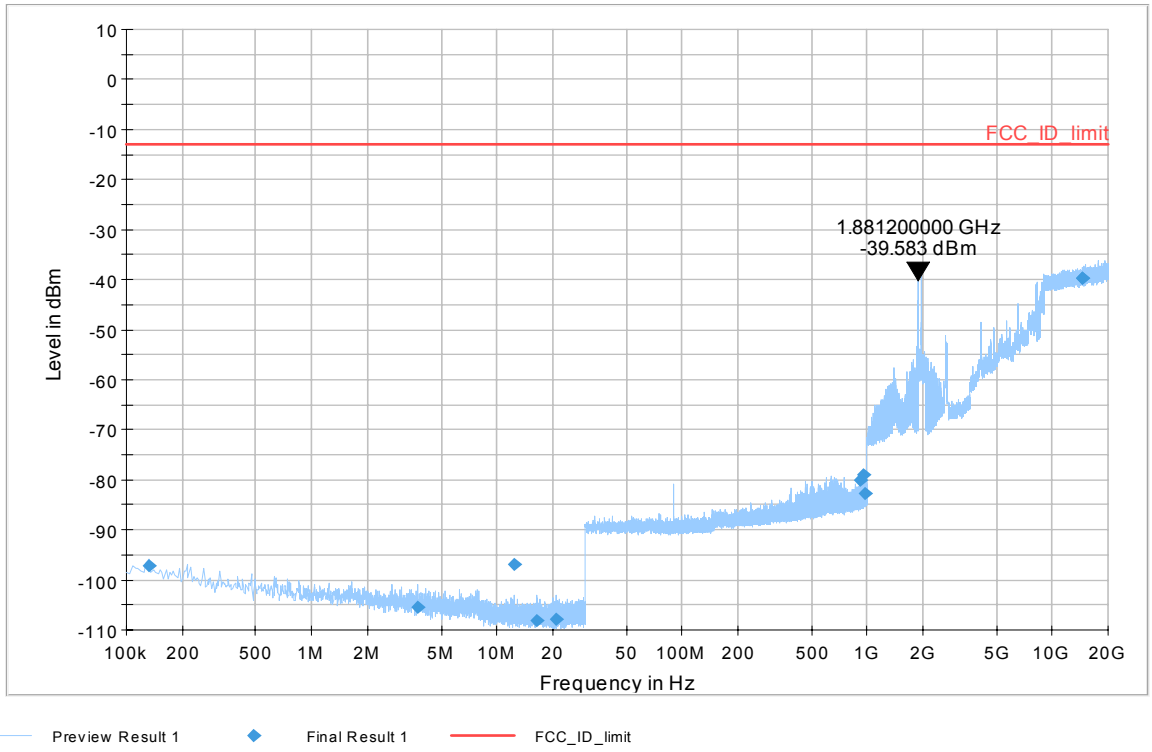
channel 660

band	Resolution bandwidth
100KHz - 30MHz	10 KHz
30MHz - 1000MHz	100 KHz
1GHz – 9GHz	1000 KHz



As show graphic no relevant spurious level are detected

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5. LIST OF EQUIPMENT USED

EQUIPMENT	MANUFACTURER	MODEL	SERIAL N.	CAL. DUE
RF SEMI-ANECHOIC CHAMBER (CSSA)	SIEMENS	B83117-D6019-T232	003-005-134/94C	APR.2010
EMI RECEIVER	ROHDE & SCHWARZ	ESMI	835862/016+838325/007	OCT.2008
EMI TEST RECEIVER 20HZ 40GHZ	ROHDE & SCHWARZ	ESU40	100111	JUL.2009
NOCH FILTER	WAINWRIGHT	WRCD 1700/2000	32	OCT 2008
NOCH FILTER	WAINWRIGHT	WRCA 800/960	15	OCT 2008
HIGH PASS FILTER	WAINWRIGHT	WHK 1,3/15G	9	OCT 2008
HIGH PASS FILTER	WAINWRIGHT	WHK 2,8/18G	1	OCT 2008
BILOG ANTENNA	CHASE	CBL6111A	1798	JUL.2009
LOW NOISE PREAMPLIFIER 18-40 GHz	BONN ELEKTRONIK	BLMA 1840-1A	087084B	AGO.2009
LOW NOISE PREAMPLIFIER 1-18GHz	BONN ELEKTRONIK	BLMA 0118-M	087084A	AGO.2009
LOG PERIODIC ANTENNA BROAD BAND 1-18 GHZ	ROHDE & SCHWARZ	HL025	350380/007	DEC.2009
SPECTRUM ANALYZER	ROHDE & SCHWARZ	FSP40	100038	DEC.2008
CONICAL LOG SPIRAL ANTENNA	ANTENNA RESEARCH ASSOC., INC.	CLS-110/A	1003	AGO.2009
HORN ANTENNA	SCHAFFNER	BBHA 9170	111	-
RF SIGNAL GENERATOR 10MHZ - 40 GHZ	ROHDE & SCHWARZ	SMP 04	825007/005	JUL 2009
WIRELESS COMMUNICATIONS TEST SET	AGILENT	8960 SERIES 10	E5515C	_

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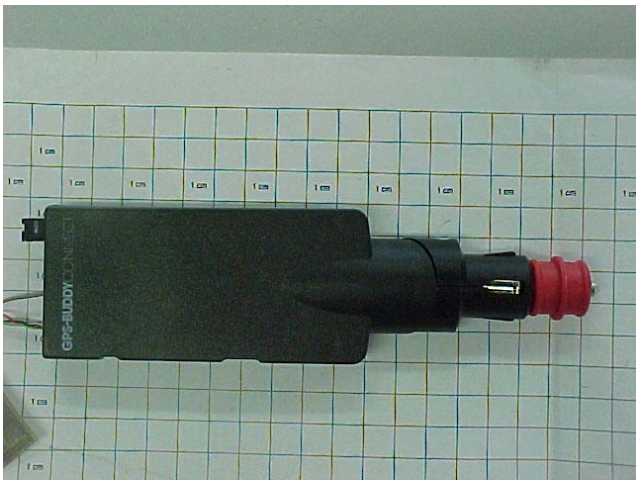
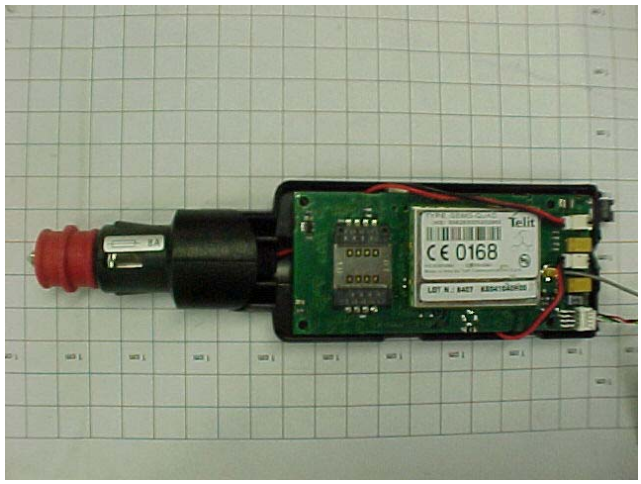
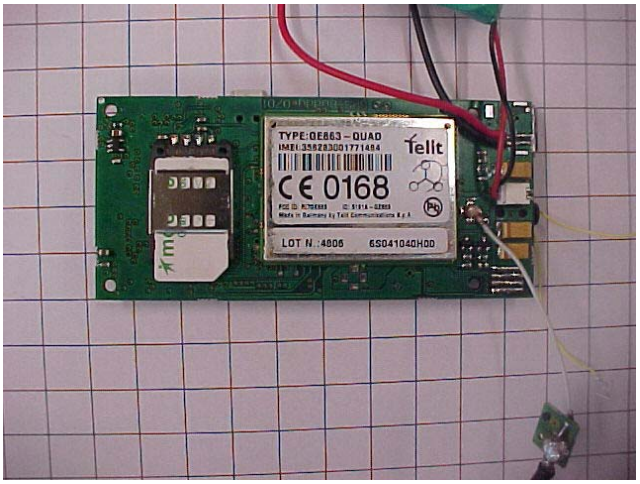
6 .PHOTOGRAPHIC DOCUMENTATION

PHOTO N° 1 –EUT IDENTIFICATION







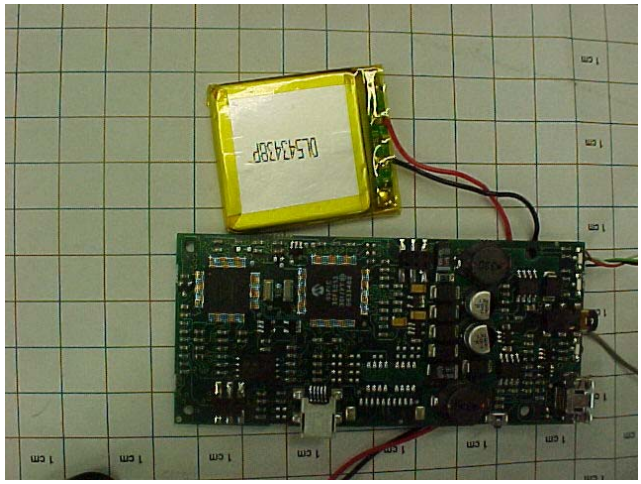


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PHOTO N° 2 –SETUP FIELD STRENGTH OF SPURIOUS RADIATION