



Project: **09CA53178**
File: **TC8379**
Report: **09CA53178RU-FCC**
Date: **Nov.25, 2009**
Model: **PW850-GW RU**

FCC Test Report

47 CFR Part 22 Subpart H Cellular Radiophone Service

For

FCC ID : T7MPW850GWATT

Kisan Telecom Co., Ltd.

**2F, Segi Bldg., 666-2, Bangyi-Dong,
Songpa-Gu, Seoul, 138-828, Korea**

UL Korea Ltd.

33rd Fl. GFC Tower, 737 Yeoksam-Dong, Gangnam-Gu, Seoul, 135-984, Korea

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Test Report Details :

Tests Performed By:	UL Korea Ltd. 33 rd FL. Star Tower 737 Yeoksam-dong, Kangnam-ku, Seoul, 135-984, Korea
Test Site:	ESTECH Co.,Ltd. 97-1, Hoeok-Ri, Majang-Myun, Icheon-City, Kyonggi-Do, 467-811, Korea
	FCC Registration No. : 94696
Tests Performed For:	Kisan Telecom Co.,Ltd. 2F, Segi Bldg., 66-2, Bangyi-dong, Songpa-Gu, Seoul, 138-828, Korea
Applicant Contact:	In-Jong, Jeong Principal Engineer / RF Technology & Development Dept. Title: Phone: Fax: E-mail:
	+82 2-3433-8384 +82 2-3433-8390 porsche@kisantel.co.kr
Test Report Number:	09CA53178RU-FCC
Test Report Date:	Nov.25, 2009
Equipment Class:	TNB - Licensed Non-Broadcast Station Transmitter
Product Type:	Optical DAS RU
Model Number:	PW850-GW RU
FCC ID:	T7MPW850GWATT
Test standards	47 CFR Part 2, Part 15 Subpart B, Part 22 Subpart H
Sample Serial Number:	Prototype
Sample Receive Date:	2009-11-16
Testing Start Date:	2009-11-16
Date Testing Complete:	2009-11-18
Overall Results:	Complied

UL Korea as an affiliate of Underwriters Laboratories Inc. EMC report apply only to the specific test samples and test results submitted for UL's review. All samples tested were in good operating condition throughout the entire test program. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. UL Korea Ltd. shall have no liability for any deductions, inferences or generalizations drawn by the client or others from UL Korea Ltd. issued reports. This report shall not be used to claim, constitute or imply product certification, approval, or any agency of the National Authorities. This report may contain test results that are not covered by the NVLAP or KOLAS accreditation.

Summary of Testing:

The following tests were performed on a sample submitted for evaluation of compliance with 47 CFR Part 22 Subpart H and Part 15 Subpart B.

Test #	Test Name Test Requirement/Specification	Compliant	Not Compliant	See Remark
1	Part 15, Subpart B Section 15.109(a)/ CISPR 22:1997 Class A Radiated Emissions - 30 to 1000 MHz Electric Field	X	-	2)
2	Part 15, Subpart B Section 15.107(a) / CISPR 22:1997 Class A Conducted Emissions	X	-	2)
3	RF Power Output - § 2.1046, § 22.913	X		
4	Audio Frequency Response - § 2.1047	-	-	1)
5	Modulation Limiting - § 2.1047	-	-	1)
6	Occupied Bandwidth - § 2.1049(i)	X		
7	Spurious Emission at antenna terminal - § 2.1051, § 22.917	X		
8	Radiated Spurious Emission - § 2.1053, § 22.917	X		
9	Frequency Stability - § 2.1055 , § 22.355	X		
11	RF Exposure			3)

Remarks:

- 1) Not applicable to this EUT.
- 2) Emissions Data can also be considered applicable to FCC Part 15 Subpart B Class A.
- 3) RF Exposure will be addressed at the time of licensing.
- 4) Modifications to EUT required for compliance: NONE.

Conclusion:

The tests listed in the Summary of Testing section of this report have been performed and the results recorded by UL Korea Ltd. in accordance with the procedures stated in each test requirement and specification. The test list was determined by the Applicant as being applicable to the Equipment Under Test. As a result, the subject product has been verified to comply or not comply as noted in the Summary of Testing with each test specification. The test results relate only to the items tested.

Tested By:



Kyung Yong, Kim
Senior EMC Engineer
UL Korea Ltd.

Reviewed By:



Jea Woon, Choi
EMC Engineer
UL Korea Ltd.

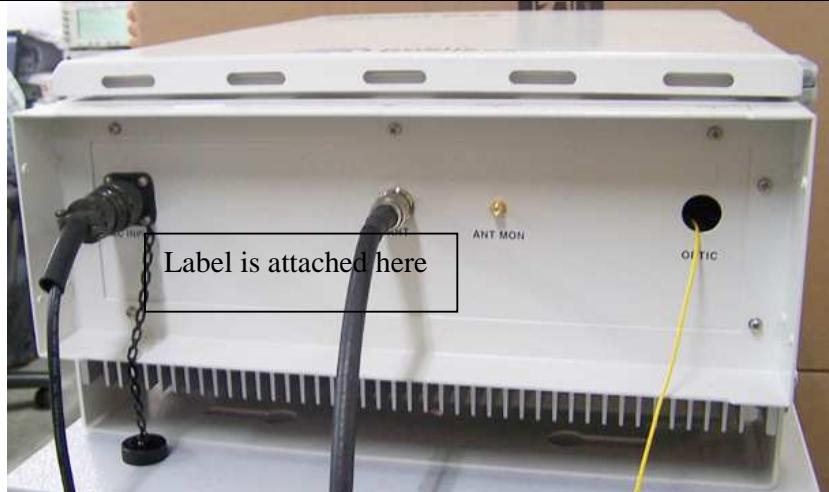
1. G E N E R A L - Product Description

1.1 Equipment Description

PW850-GW repeater is an equipment to clear the shadows and fill the gaps existing among the adjacent cells and enhances the quality of services by extending coverage of GSM and WCDMA. To make up the network configuration, the repeater PW850-GW RU need the use of Fiber Optic Donor to connect the base station.

Items	Standards	
Frequency Range	GSM Down link Transmitting : 869.4 ~ 891.4 MHz Receiving : 824 ~ 849 MHz	WCDMA - Down link Transmitting : 872.5 ~ 887.5 MHz Receiving : 824 ~ 849 MHz
	* Note : This repeater unit has no Up-link RF output antenna terminal because the Uplink signal to Base station is transmitted with Fiber Optic conversion.	
Output Power	37 dBm / channel	37 dBm / FA
Channel Spacing	200 kHz	5 MHz
Modulation	GMSK	WCDMA
Emission Designator	GXW	F9W
Amplifier Gain	72 dB	72 dB
Input Level	-40 ~ -20dBm/Total	-40 ~ -20dBm/FA
Gain Control Range	20 dB by 1dB step	20 dB by 1dB step
VSWR	1.5:1	1.5:1
Optical Wavelength	FWD : 1310nm RVS : 1550nm	
I/O connector	Antenna port : 50Ω N-Type (Female) Optic port : FC/APC	
Cabinet	Indoor type	
Size (WxHxD)	450 x 630 x 255 mm	
Working temperature	-20°C ~ 50°C	
Electrical Rating	110 VAC, 60Hz	
Power connector	Type : MS3106A16-10S	

1.2 Equipment



1.3 Equipment Marking Plate

Optical DAS RU **FCC ID: T7MPW850GWATT**

Model: PW850-GW



Kisan telecom

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:
(1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

2. Test Conditions

2.1 Equipment Used During Test

Use*	Product Type	Manufacturer	Model	Comments
EUT	Optical DAS Repeater	Kisan Telecom	PW850-GW RU	Indoor metal enclosure
AE	RF Attenuator	INMET	30 dB	
AE	RF Attenuator	HP	30 dB	

Note:
* **EUT** - Equipment Under Test, **AE** - Auxiliary/Associated Equipment, or **SIM** - Simulator (Not Subjected to Test)

2.2 Input/Output Ports

Port #	Name	Type*	Cable Max. >3m (Y/N)	Cable Shielded (Y/N)	Comments
0	Enclosure	N/E	—	—	Metal cabinet type (indoor purpose)
1	Mains (AC input)	AC	N	N	1.5m length. Manufacturer provided
2	Antenna port (Doner)	OP	Y	Y	Connected to Donor Fiber Optic
3	Antenna port (Service)	CO	Y	Y	Connected to external antenna
4	External Ground		N	N	Manufacturer provided
5	Coupling Port	-	-	-	No use : Maintenance purpose only
6	Coupling Port	-	-	-	No use : Maintenance purpose only
7	Mains (DC out)	-	-	-	No use : Maintenance purpose only

Note:
- AC = AC Power Port DC = DC Power Port N/E = Non-Electrical
- CO = Coaxial Port OP = Optical port
- I/O = Signal Input or Output Port (Not Involved in Process Control)
- TP = Telecommunication Ports
- All the cable used were provided by the applicant.

2.3 Test Equipments used

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Signal Generator	Agilent	E4438C	MY45095542	2008-11-28	2009-11-28
Signal Generator	Agilent	E4438C	MY45093570	2009-04-24	2010-04-30
Spectrum Analyzer	Agilent	E4440A	MY42510388	2009-11-11	2010-11-11
Fixed Attenuator	HP	8496A - 30 dB	3318A07585	-	-
Fixed Attenuator	INMET	30 dB	992310-29	-	-
Frequency Divider	KEP	4KEPDC2WS-A	-	-	-
Temp Controller	Yokogawa	-	HR-332-08-0125	2009-02-17	2010-02-17

2.4 Power Interface

Mode #	Voltage (V)	Frequency (DC/AC-Hz)	Phases (#)	Comments
Rated	108~127Vac	60Hz	Single Phase	Nominal voltage
1	120Vac	60Hz	Single Phase	Test voltage
2	108Vac	60Hz	Single Phase	Voltage variation (Nominal-15%)
3	138Vac	60Hz	Single Phase	Voltage variation (Nominal+15%)

2.5 EUT Internal Operating Frequencies

Frequency (MHz)	Description	Frequency (MHz)	Description
13 MHz	TCXO, PLL Reference clock		
10 MHz	XCLK, X1 - NMS		
25 MHz	X2-NMS		
29.4912 MHz	X3, UART-NMS		

Note : The frequency info was provided by the applicant.

2.6 EUT Operation Modes

Mode #	Description
1	Down link transmission for GSM and WCDMA
-	-

Note:

- This Optical repeater has just one output port for down link (forward). The Up link is configured with Donor through optic signal transmission.

2.7 EUT Operating Frequencies

Mode #	Description
GSM	Down link : 3 frequencies (Low, Mid, High channels) for assigned frequency band <ul style="list-style-type: none">- Bottom channel : 869.4 MHz- Mid channel : 880.2 MHz- Top channel : 891.4 MHz
WCDMA	Downlink : 3 frequencies (Low, Mid, High FAI) for assigned frequency band <ul style="list-style-type: none">- Bottom channel : 872.5 MHz- Mid channel : 882.5 MHz- Top channel : 887.5 MHz

2.8 Test Signal Source

The carrier from the signal generator applied to the repeater was GSM and WCDMA standard signal.

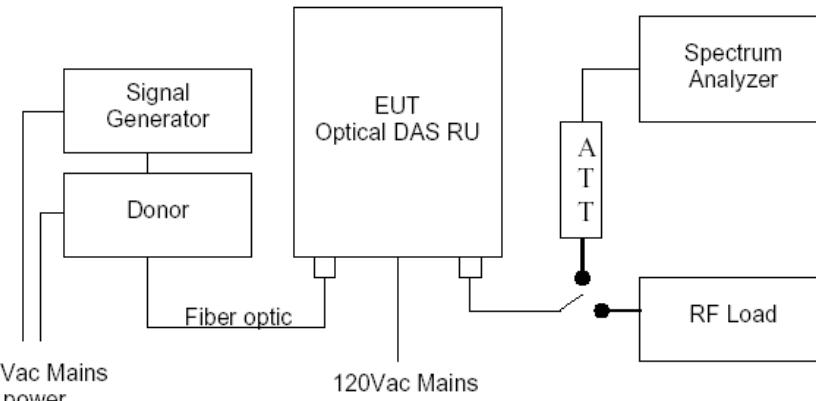
GSM

- Data format : Pattern , Bits/Symbol :1, Data : PN23
- Modulation Type : MSK, Sym rate : 270.833333 kSPS
- GSM : Standard
- Filter : 0.3 Gaussian
- I/Q Scaling : 100%

WCDMA 3GPP

- Test mode 1 w/64 DPCH
- Chip Rate : 3.840000Mcps
- Filter : WCDMA
- IQ Mod Filter : 2.100 MHz
- IQ Mapping : Normal
- PRE Clip : 100%

2.9 EUT Configurations

Mode #	Test Configuration
1	 <p>RF Test</p> <p>Emission Test</p>
Note	<p>- Emission measurement : The GSM and WCDMA RF signal from the Donor was injected to the input port of the repeater through fiber optic cable and output port was terminated with 50 ohm RF load.</p> <p>- RF measurement : The GSM and WCDMA RF signal from the Donor was injected to the input port of the repeater through fiber optic cable and the amplified RF output signal was connected to the Spectrum analyzer.</p>

2.10 Test Lab Environmental Condition

Parameters required prior to the test	Laboratory Ambient Temperature	10 to 40 °C
	Relative Humidity	10 to 90 %
Parameters recorded during the test	Laboratory Ambient Temperature	20 °C
	Relative Humidity	40 %

2.11 Test Specifications

Standard Number	Standard Name	Standard Date
CFR 47 Part 22 Subpart H	Public Mobile Services - Cellular Radiophone Service	2008
CFR 47 Part 15 Subpart B	General Technical requirements	2008
ANSI C63.4-2003	Methods of Measurements of Radio-Noise Emission from Low voltage and electrical equipment in the range of 9kHz~40GHz	2003

EIA/TIA-603 Edition C 2004	Land Mobile FM or PM communication equipment measurement and performance standards	2004
FCC 2-11-04	EAB/RF Amplifier, Booster, and Repeater reminder	2004

2.12 Test Laboratory Details

All the testing has been performed by UL Korea engineer at both test laboratories described below. The radiated spurious emission measurements were performed in a 10 meter open site which has been filed to the commission in accordance with section 2.948 at Estech Co.,Ltd.

Persons who have been presented during the test : In-Jong, Jeong (Principal Research engineer / Kisan Telecom)

Measurement Uncertainties

Test	Uncertainty
Radiated Emissions	± 2.93 [dB], k=2 (Trust level 95%)
Conducted Emissions	± 2.93 [dB], k=2 (Trust level 95%)

3. Test Results

3.1 Test Conditions and Results – Conducted emissions at mains terminal

Test Description	Measurements were made on a ground plane. All power was connected to the system through Artificial Mains Network (AMN). Conducted voltage measurements on mains lines were made at the output of the AMN.			
Basic Standard	ANSI C63.4-2003, 47 CFR § 15.107(b)			
Parameters required prior to the test	Laboratory Ambient Temperature		10 to 40 °C	
	Relative Humidity		10 to 90 %	
Parameters recorded during the test	Laboratory Ambient Temperature		25 °C	
	Relative Humidity		35 %	
	Frequency range on each side of line		Measurement Point	
Fully configured sample scanned over the following frequency range	150kHz to 30MHz		Mains	
Limits - Class A				
Frequency (MHz)	Limit (dB μ V)			
	Quasi-Peak	Results	Average	Results
0.15 to 0.50	79	Pass	66	Pass
0.50 to 30	73	Pass	60	Pass
Supplementary information: None				

Conducted Emissions EUT Configuration Settings

Power Interface Mode # (See Section 2.4)	EUT Configurations Mode # (See Section 2.9)	EUT Operation Mode # (See 2.6)
1	1	1
Supplementary information:		

Conducted Emissions Test Equipment

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Test Receiver	Rohde & Schwarz	ESPI7	100185	2009-08-25	2010-08-25
LISN	Schwarzbeck	NNLA8120A	8120161	2009-02-21	2010-02-21
LISN	Rohde & Schwarz	ESH3-Z5	838979/010	2009-02-21	2010-02-21
Pulse Limiter	Rohde & Schwarz	ESH3Z2	-	2009-08-25	2009-08-25

Figure 1 Test Setup for Conducted Emissions

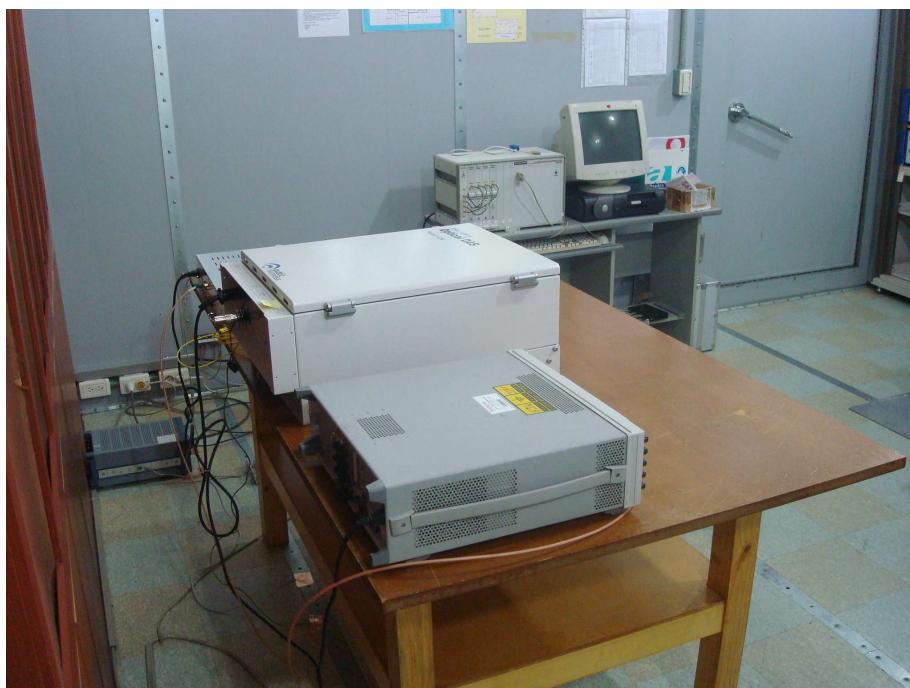


Figure 2 Conducted Emissions Graph

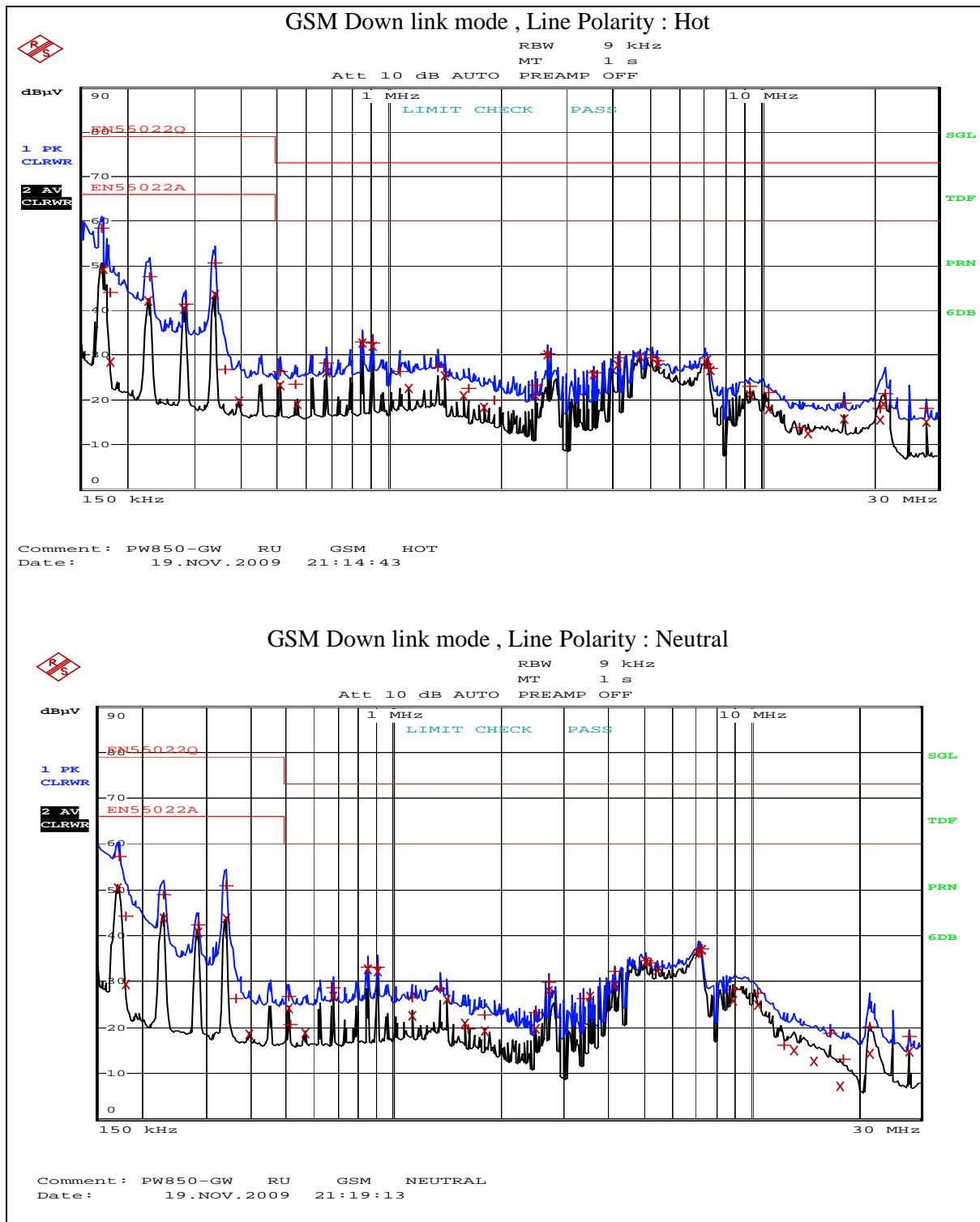


Figure 3 Conducted Emissions Graph

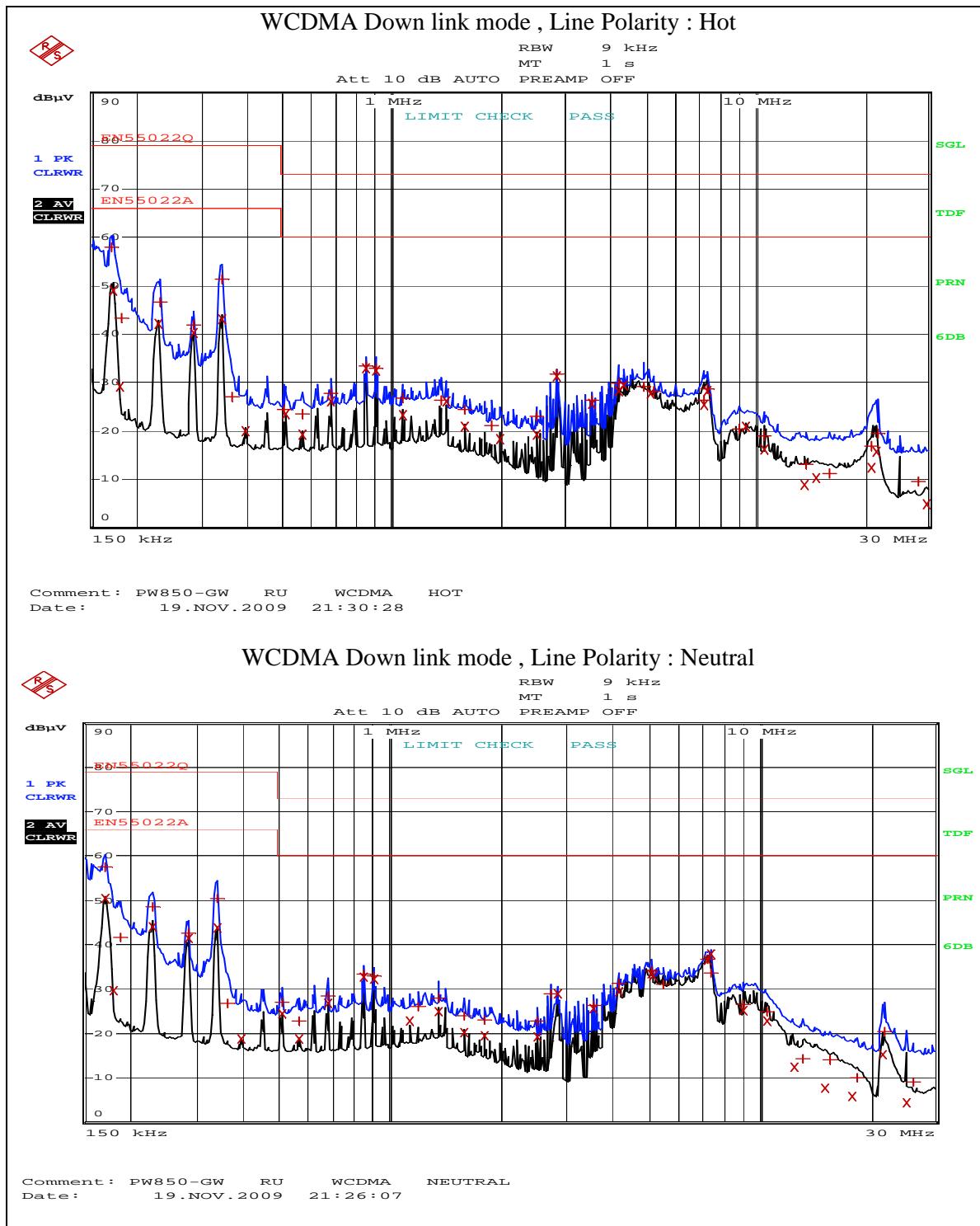


Table 1 Conducted Emissions Test Data

Operating mode : GSM Down link

Test Frequency (MHz)	Correction Factor		Reading value (dBuV)		Line	Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
	Cable	LISN	QP	AV		QP	AV	QP	AV	QP	AV
0.17	0.25	0.10	58.07	48.99	H	58.42	49.34	64.96	54.96	6.54	5.62
0.23	0.25	0.09	48.45	44.11	V	48.79	44.45	62.45	52.45	13.66	8.00
0.28	0.25	0.09	42.54	41.36	V	42.88	41.70	60.82	50.82	17.94	9.12
0.34	0.28	0.10	51.26	43.19	H	51.64	43.57	59.15	49.15	7.52	5.59
0.85	0.44	0.11	33.32	32.89	H	33.87	33.44	56.00	46.00	22.13	12.56
2.84	0.49	0.18	31.86	31.28	H	32.53	31.95	56.00	46.00	23.47	14.05
5.17	0.65	0.24	34.08	33.41	V	34.97	34.30	60.00	50.00	25.03	15.70
7.38	0.80	0.32	37.90	33.58	V	39.01	34.69	60.00	50.00	20.99	15.31
7.43	0.80	0.39	28.73	28.13	H	29.92	29.32	60.00	50.00	30.08	20.68

Note:

1. Margin (dB)= Limit (dBuV) - Level (dBuV)
2. If no frequencies are specified in the tables, no measurement for quasi-peak or average was necessary.
3. The emission data reported is the worst case emission data of which GSM carrier tuned at 880.2 MHz.

Operating mode : WCDMA Down link

Test Frequency (MHz)	Correction Factor		Reading value (dBuV)		Line	Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
	Cable	LISN	QP	AV		QP	AV	QP	AV	QP	AV
0.17	0.10	0.25	58.36	49.18	H	58.71	49.53	54.96	54.96	6.25	5.43
0.18	0.09	0.25	44.20	29.20	N	44.54	29.54	54.49	52.45	19.95	24.95
0.23	0.09	0.25	49.07	43.77	N	49.41	44.11	52.45	50.82	13.04	8.34
0.34	0.09	0.28	50.95	43.71	N	51.32	44.08	49.20	49.15	7.89	5.13
0.85	0.11	0.44	33.19	32.74	N	33.74	33.29	46.00	46.00	22.26	12.71
2.66	0.18	0.48	30.46	30.16	H	31.11	30.81	46.00	46.00	24.89	15.19
5.10	0.23	0.65	34.70	34.31	N	35.58	35.19	50.00	50.00	24.42	14.81
7.31	0.32	0.79	37.25	36.91	N	38.36	38.02	50.00	50.00	21.64	11.98
27.78	1.16	1.41	18.04	15.04	H	20.61	17.61	50.00	50.00	39.39	32.39

Note:

1. Margin (dB)= Limit (dBuV) - Level (dBuV)
2. If no frequencies are specified in the tables, no measurement for quasi-peak or average was necessary.
3. The emission data reported is the worst case emission data of which WCDMA carrier tuned at 882.5 MHz.

3.2 Test Conditions and Results – Radiated Emissions

Test Description	Measurements were made in a 10-meter open field test site that complies to CISPR 16/ANSI C63.4. Preliminary (peak) measurements were performed at semi anechoic chamber with antenna to EUT separation distance of 3 meter. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in both horizontal and vertical polarities. Final measurements (quasi-peak or average as noted) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4-meters. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable. Measurement has been performed in the frequency range from 30 MHz to 10 GHz.	
Basic Standard	ANSI C63.4-2003, 47 CFR § 15.109 Class A	
Parameters required prior to the test	Laboratory Ambient Temperature	10 to 40 °C
	Relative Humidity	10 to 90 %
Parameters recorded during the test	Laboratory Ambient Temperature	16 °C
	Relative Humidity	50 %
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	30MHz – 10GHz	10 meter measurement distance
Limits - Class A		
Frequency (MHz)	Limit (dB μ V/m)	
	Quasi-Peak	Results
30 to 230	40	Pass
230 to 1000	47	Pass
1000 to 10 GHz	49.5	Pass
Limits - Class B		
Frequency (MHz)	Limit (dB μ V/m)	
	Quasi-Peak	Results
30 to 230	30	N/A
230 to 1000	37	N/A
Above 1 GHz		
Supplementary information: Class A limit applied		

Radiated Emissions EUT Configuration Settings

Power Interface Mode # (See Section 2.4)	EUT Configurations Mode # (See Section 2.9)	EUT Operation Mode # (See Section 2.6)
1	1	1
Supplementary information:		

Radiated Emissions Test Equipment

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Receiver	Rohde & Schwarz	ESVS10	838562/002	2009-01-21	2010-01-21
Spectrum Analyzer	Advantest	R3273	110600592	2009-06-04	2010-06-04
Logbicon Antenna	Schwarzbeck	VULB 9160	3142	2009-05-13	2010-05-13
Preamplifier	HP	8449B	3008A00581	2009-03-06	2010-03-06
Amplifier	HP	8447F	2805A02972	2009-06-24	2010-06-24
Horn Antenna	Schwarzbeck	BBHA 9120 D	352	2009-06-17	2010-06-17

Figure 3 Test setup for Radiated Emissions



Table 2 Radiated Emissions Data

Operating mode : GSM Down link

Test Frequency (MHz)	Meter Reading (dBuV)	Detector (Pk/QP)	Polarity (V/H)	Azimuth (°)	Antenna Height (m)	Gain/Loss Factor (dB)	Antenar Factor (dB/m)	Level dBuV/m	Limit dBuV/m	Margin [dB]
32.01	9.20	QP	H	120	400	0.9	11.18	21.28	40.0	18.72
75.02	11.20	QP	H	75	400	1.3	8.96	21.49	40.0	18.51
116.23	15.80	QP	H	95	400	1.7	10.82	28.33	43.5	15.17
120.02	14.10	QP	H	177	400	1.8	11.18	27.04	43.5	16.46
125.00	12.10	QP	H	162	400	1.8	11.58	25.45	43.5	18.05
175.00	7.40	QP	H	180	400	2.2	11.50	21.10	43.5	22.41
192.01	10.10	QP	H	187	400	2.3	10.24	22.66	43.5	20.84
250.00	15.30	QP	V	182	100	2.8	11.40	29.49	46.0	16.51
375.00	17.20	QP	H	287	275	3.8	14.57	35.60	46.0	10.41
400.02	7.40	QP	H	128	230	4.0	15.14	26.54	46.0	19.46
500.01	12.00	QP	H	257	202	4.8	17.10	33.85	46.0	12.15
625.00	12.20	QP	V	292	310	5.7	19.76	37.62	46.0	8.39

Supplementary information:

- Margin = Class A Limit – Emission Level
- All other emissions not reported were more than 25 dB below the permitted limit.
- The emission data reported is the worst case emission data taken at Down link mode @ 880.2 MHz.

Operating mode : WCDMA Down link

Test Frequency (MHz)	Meter Reading (dBuV)	Detector (Pk/QP)	Polarity (V/H)	Azimuth (°)	Antenna Height (m)	Gain/Loss Factor (dB)	Antenar Factor (dB/m)	Level dBuV/m	Limit dBuV/m	Margin [dB]
32.01	8.50	QP	V	120	100	0.9	11.18	20.58	40.0	19.42
116.01	14.10	QP	H	75	400	1.7	10.80	26.60	43.5	16.90
126.24	12.60	QP	H	95	400	1.8	11.68	26.05	43.5	17.45
125.01	12.70	QP	H	177	400	1.8	11.58	26.05	43.5	17.45
162.15	7.90	QP	H	162	400	2.1	12.55	22.53	43.5	20.97
250.00	10.20	QP	V	187	100	2.8	11.40	24.39	46.0	21.61
325.00	10.30	QP	V	187	100	3.5	13.48	27.23	46.0	18.78
375.02	17.00	QP	H	182	243	3.8	14.57	35.40	46.0	10.60
400.01	7.10	QP	H	287	222	1.0	15.14	22.24	40.0	18.76
500.01	11.70	QP	H	128	2.0	4.8	17.10	33.55	46.0	12.45
625.00	11.30	QP	V	257	3.0	5.7	19.76	36.72	46.0	9.29

Supplementary information:

- Margin = Class A Limit – Emission Level
- All other emissions not reported were more than 25 dB below the permitted limit.
- The emission data reported is the worst case emission data taken at Down link mode @ 882.5 MHz.

3.3 Test Conditions and Results – RF Power Output

Test Description	Measurements were made in the laboratory environment. For RF power measurements, all calculations and methods used by the applicant for determining carrier power or peak envelope power, as appropriate, on the basis of measured power in the radio frequency load attached to the transmitter output terminals shall be shown. The EUT was adjusted to produce maximum power rating of the product specification. The measurements were made at the EUT RF output ports in downlink transmit operation mode at B,M,T channels.			
Basic Standard	47 CFR § 2.1046, § 22.913			
RF Power output Limit				
§ 22.913 (a) The effective radiated power (ERP) of base transmitters and cellular repeaters must not exceed 500 Watts.				
Parameters required prior to the test	Laboratory Ambient Temperature	10 to 40 °C		
	Relative Humidity	10 to 90 %		
Parameters recorded during the test	Laboratory Ambient Temperature	21 °C		
	Relative Humidity	40 %		

RF output power Configuration Settings

Power Interface Mode # (See Section 2.4)	EUT Configurations Mode # (See Section 2.9)	EUT Operation Mode # (See 2.6)
1	1	1
Supplementary information: None		

Test Equipment

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Signal Generator	Agilent	E4438C	MY45095542	2008-11-28	2009-11-28
Signal Generator	Agilent	E4438C	MY45093570	2009-04-24	2010-04-30
Spectrum Analyzer	Agilent	E4440A	MY42510388	2009-11-11	2010-11-11
Fixed Attenuator	HP	8496A - 30 dB	3318A07585	-	-
Fixed Attenuator	INMET	30 dB	992310-29	-	-

Figure 4 Test setup for Conducted Measurement

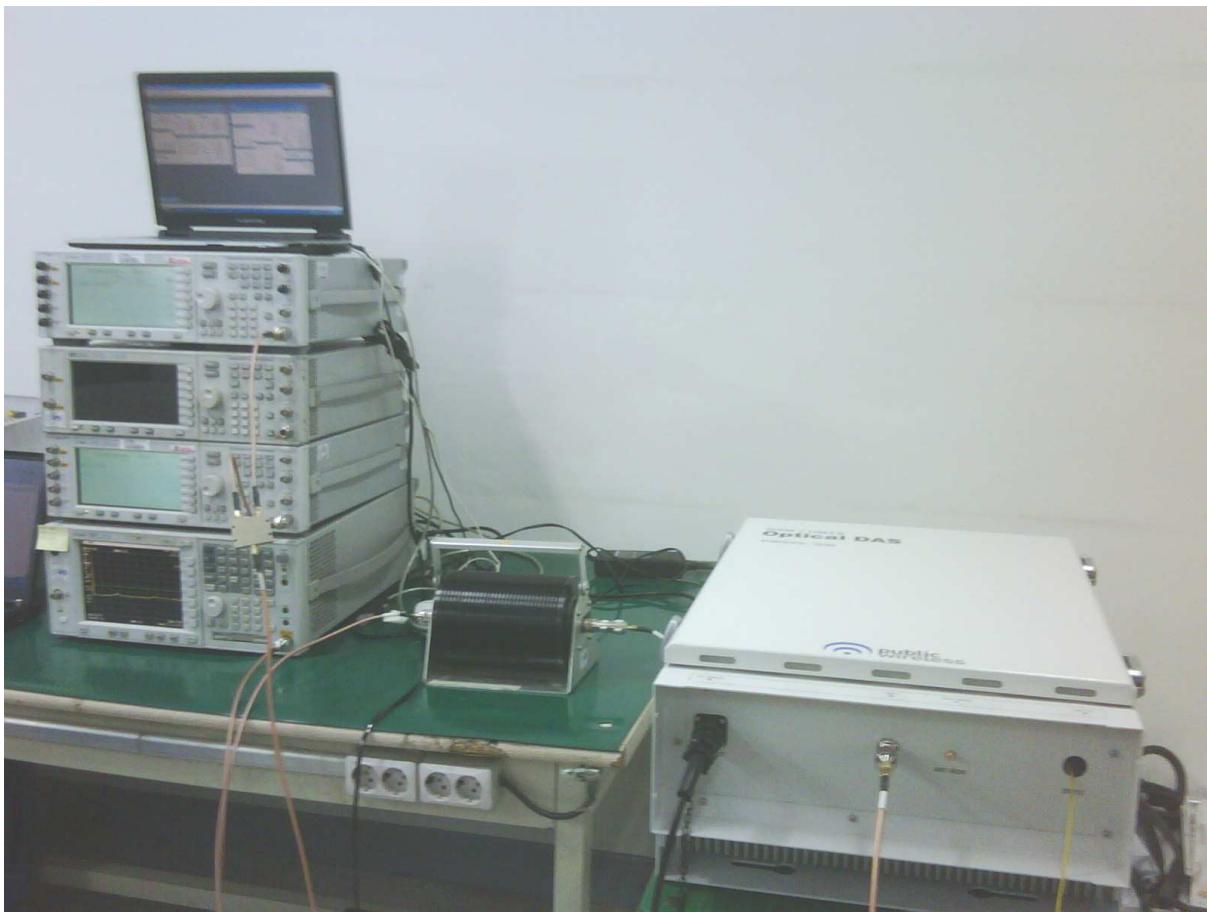


Table 3 RF output power data

Modulation	Frequency (MHz)	Loss offset (dB)	Measured Power (dBm)	Composite power (dBm)	Limit (dBm)
GSM	869.4	32.8	35.37	-	57
	880.2	32.8	37.02	-	57
	891.4	32.8	34.54	-	57
WCDMA	872.5	33.8	37.19	-	57
	882.5	33.8	37.45	-	57
	887.5	33.8	37.47	-	57

Supplementary information:

- .. Down link mode
- .. Modulated RF output power
- .. Power measurement : Channel power w/ peak value
- .. Before the measurement, the system calibration for compensation of cable loss and attenuator has been made and included as an offset value in every measurement.
- .. The manufacturer's specification for RF output power 37 dBm is Total power. The total power of 2 composite RF output is the same as 1 single output power. If the two channels for GSM is used, the each single channel power is reduced to 34 dBm(3dB reduce from the single channel power) to meet the total power 37 dBm limitation.

Remarks :

Refer to the Measurement plots provided in Annex 1 no. : 1 - 6

Result of test

In accordance with Technical requirement of FCC Rules section 47 CFR § 2.1046, § 22.913

Complied Failed

3.4 Test Conditions and Results – Occupied Bandwidth

Test Description	Measurements were made in the laboratory environment. 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 radiated by a given emission shall be measured. The modulated carrier signal with maximum RF level was applied to the up and down link input of the repeater and resulting output was compared against the original signal.			
Basic Standard	47 CFR § 2.1049			
Occupied Bandwidth Limits				
According to the FCC 2-11-04/EAB/RF, Input and output signals were compared to verify that there was no any degradation to the signal due to amplification and conversion from the repeater using an RBW of 300 Hz or 1% of the emission bandwidth.				
Parameters required prior to the test	Laboratory Ambient Temperature	10 to 40 °C		
	Relative Humidity	10 to 90 %		
Parameters recorded during the test	Laboratory Ambient Temperature	23 °C		
	Relative Humidity	40 %		

Occupied Bandwidth Configuration Settings

Power Interface Mode # (See Section 2.4)	EUT Configurations Mode # (See Section 2.9)	EUT Operation Mode # (See 2.6)
1	2, 3	2, 3
Supplementary information: None		

Occupied Bandwidth Spectrum Analyzer Settings

Span	Resolution Bandwidth	Occupied Bandwidth Requirements	
		dBc	%
2 MHz (GSM) 10 MHz (WCDMA)	3 kHz 300 Hz	-26	99
Supplementary information: 99% bandwidth was applied.			

Occupied Bandwidth Test Equipment

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Signal Generator	Agilent	E4438C	MY45095542	2008-11-28	2009-11-28
Signal Generator	Agilent	E4438C	MY45093570	2009-04-24	2010-04-30
Spectrum Analyzer	Agilent	E4440A	MY42510388	2009-11-11	2010-11-11
Fixed Attenuator	HP	8496A - 30 dB	3318A07585	-	-
Fixed Attenuator	INMET	30 dB	992310-29	-	-

Table 4 Occupied Bandwidth results

Modulation	Occupied bandwidth			
	Frequency (MHz)	Input port	Output port	
			99%	26dB
GSM	869.4	-	245.29 kHz	313.42 kHz
	880.2	-	240.57 kHz	305.97 kHz
	891.4	-	245.38 kHz	302.63 kHz
WCDMA	872.5	-	4.13 MHz	4.60 MHz
	882.5	-	4.13 MHz	4.60 MHz
	887.5	-	4.12 MHz	4.60 MHz

Supplementary information:

- .. Modulated RF signal applied, 99% bandwidth
- .. Measurement at input port of the repeater can not be performed because of the Optic signal from the donor unit.

Remarks :

Refer to the Measurement Plots provided in Annex 1 no. : 7 - 12

Result of test

In accordance with Technical requirement of FCC Rules section 47 CFR § 2.1049

Complied Failed

3.5 Test Conditions and Results – Spurious Emission at Antenna Terminal

Test Description	Measurements were made in the laboratory environment. Conducted spurious emission measurement was made using a direct connection between RF output of the EUT and spectrum analyzer via RFAttenuator. A modulated carrier signal from the donor was applied to the optic input port of the EUT. Measurement has been performed with the EUT set to maximum output level at low, mid and high channel frequencies. The spectrum was investigated from 30 MHz to up to 10 th harmonics of the carrier frequencies. Inter-modulation requirements were performed with two modulated carriers set at 2 or 3 channel deviation. One carrier was set at the band edge of both Uplink and Downlink and other carrier was set at 3 channel deviation from the edge channel(N+3, N-3)			
Basic Standard	47 CFR § 2.1051, § 22.917(a)			
Emission Limits				
§ 22.917 Emission limitations for cellular equipment (a) Out of band emissions : The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.				

Emission Mask Configuration Settings

Power Interface Mode # (See Section 2.4)	EUT Configurations Mode # (See Section 2.9)	EUT Operation Mode # (See 2.6)
1	1	1
Supplementary information: None		

Conducted spurious emission Spectrum Analyzer Settings

Frequency Range (MHz)	Resolution Bandwidth	Video Bandwidth
30 MHz ~ 1 GHz	100 kHz	300 kHz
1 GHz ~ 10 GHz	1 MHz	3 MHz
Supplementary information:		

Conducted Spurious Emission Test Equipment

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Signal Generator	Agilent	E4438C	MY45095542	2008-11-28	2009-11-28
Signal Generator	Agilent	E4438C	MY45093570	2009-04-24	2010-04-30
Spectrum Analyzer	Agilent	E4440A	MY42510388	2009-11-11	2010-11-11
Fixed Attenuator	HP	8496A - 30 dB	3318A07585	-	-
Fixed Attenuator	INMET	30 dB	992310-29	-	-

Table 5 Out of band emission – Spurious emissions results

Modulation	Tuned Frequency (MHz)	Loss offset (dB)	Spurious emission measured (dBm)	Limit (dBm)	Margin (dB)
GSM	869.4	33.8	-24.55	-13	11.55
	880.2	33.8	-23.68	-13	10.68
	891.4	33.8	-23.55	-13	10.55
WCDMA	872.5	33.8	-24.56	-13	11.56
	882.5	33.8	-24.17	-13	11.17
	887.5	33.8	-23.84	-13	10.84
Supplementary information:					
<ul style="list-style-type: none"> - Modulated carrier signal was applied to the input of the repeater. - Power measurement : Peak power measured - For each tuned carrier frequency, the maximum spurious emission detected was recorded. 					

Out of band emission - Two carrier Intermodulation

Carrier Band		Tuned Freq. (MHz)	Loss offset (dB)	Spurious emission measured (dBm)	Limit (dBm)	Margin (dB)
GSM	Lower N, N+3	869.4 / 870.0	32.8	-22.92	-13	9.92
	Higher N-3, N	890.8 / 891.4	32.8	-36.32	-13	23.32
WCDMA	Lower N, N+2	872.5 / 882.5	33.8	-21.18	-13	8.18
	Higher N-2, N	877.5 / 887.5	33.8	-28.94	-13	15.94
Supplementary information:						
<ul style="list-style-type: none"> - N : Edge channel for both lowest and highest at each mode.(for WCDMA N=FA) - Two modulated carrier signals were applied to the optic input of the repeater from the Donor, - Power measurement : Peak power measured - For each tuned carrier frequency, the maximum spurious emission detected was recorded. 						

Out of band emission - Band Edge Measurement

Modulation	Band edge frequency (MHz)		Carrier		Emission level (dB)	Limit (dB)	Margin (dB)
			Ch / FA	Freq.(MHz)			
GSM	Lowest	869.0	129	869.4	-40.34	-13.0	27.34
	Highest	894.0	239	891.4	-50.25	-13.0	37.25
WCDMA	Lowest	869.0	1	872.5	-22.66	-13.0	9.66
	Highest	894.0	4	887.5	-41.89	-13.0	28.89

Supplementary information:

- A modulated carrier signals were applied to the optic input of the repeater from the Donor,
- Power measurement : Peak power measured
- The emission levels at the both lowest and highest edge of the authorized bands were recorded.

Remarks :

Refer to the Measurement Plots provided in Annex 1 no. : 13 - 66

Result of test

In accordance with Technical requirement of FCC Rules section 47 CFR § 2.1051 & § 22.917

Complied Failed

3.6 Test Conditions and Results – Radiated Spurious Emission

Test Description	Measurements were made in a 10-meter open field test site that complies to CISPR 16/ANSI C63.4. Preliminary (peak) measurements were performed at semi-anechoic chamber with an antenna to EUT separation distance of 3 meter. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in both horizontal and vertical polarities. The EUT's RF output port was terminated with 50 ohm load. The EUT was set to transmit at low, mid and high channel frequencies with max output power condition. Final measurements (quasi-peak or average as noted) were then performed by rotating the EUT about 360° and adjusting the receive antenna height from 1 to 4-meters in accordance with procedure of substitution method specified in TIA/EIA-603-A-2003. All frequencies up to 10 GHz were investigated in both horizontal and vertical antenna polarity, where applicable. The maximum EIRP of the emissions were reported.			
Basic Standard	§ 2.1053 , § 22.917			
Radiated Spurious Emission LIMITS				
§ 22.917 Emission limitations for cellular equipment				
Parameters required prior to the test	Laboratory Ambient Temperature	10 to 40 °C		
	Relative Humidity	10 to 90 %		
Parameters recorded during the test	Laboratory Ambient Temperature	27 °C		
	Relative Humidity	47 %		
	Frequency range	Measurement Point		
Fully configured sample scanned over the following frequency range	1GHz – 20GHz	(3 meter measurement distance)		
Limits – EIRP				
Frequency (MHz)	Limit (dBm EIRP)			
	Peak	Average		
Harmonics up to 10 th Harmonics	-13	NA		
Supplementary information:				

Spectrum Analyzer Settings

Frequency Range (MHz)	Resolution Bandwidth	Video Bandwidth
1 GHz ~ 20 GHz	1 MHz	3 MHz
Supplementary information: Peak measurement		

Radiated Emissions EUT Configuration Settings

Power Interface Mode # (See Section 2.4)	EUT Configurations Mode # (See Section 2.9)	EUT Operation Mode # (See Section 2.6)
1	1	1
Supplementary information:		

Radiated Emissions Test Equipment

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Receiver	Rohde & Schwarz	ESVS10	838562/002	2009-01-21	2010-01-21
Spectrum Analyzer	Advantest	R3273	110600592	2009-06-04	2010-06-04
Logbicon Antenna	Schwarzbeck	VULB 9160	3142	2009-05-13	2010-05-13
Preamplifier	HP	8449B	3008A00581	2009-03-06	2010-03-06
Amplifier	HP	8447F	2805A02972	2009-06-24	2010-06-24
Horn Antenna	Schwarzbeck	BBHA 9120 D	352	2009-06-17	2010-06-17

Figure 8 Test setup for Spurious Radiated Emissions



Table 6 Spurious Radiated Emissions Data Points

Test Frequency (MHz)	Meter Reading (dBuV)	Detector (Pk/QP)	Polarity (V/H)	Azimuth (Degrees)	Antenna Height (cm)	Gain/Loss Factor (dB)	Transducer Factor (dB/m)	Level dBuV/m	Limit 1 dBuV/m	Margin (dB)

Supplementary information:

- .. There was no detectable spurious emissions from the EUT. The Uplink and Downlink harmonic emissions were at the noise floor of the spectrum analyzer.
- .. No emissions were detected within 20dB below the permitted limit.

Result of test

In accordance with Technical requirement of FCC Rules section 47 CFR § 2.1053 & § 22.917

Complied Failed

3.7 Test Conditions and Results – Frequency Stability

Test Description	For Temperature Frequency Stability, measurements were made with the product placed in an environmental chamber and the temperature varied from -30°C to +50°C at the normal supply voltage. The frequency drift of the fundamental frequency was measured with a spectrum analyzer. For Power Supply Frequency Stability, measurements were made in a laboratory environment and the supply voltage varied from 85% to 115%. The ambient temperature was 20°C.			
Basic Standard	47 CFR § 2.1055, § 22.355			
Frequency Stability Limits				
§ 22.355 Frequency stability (a) The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability of the transmitter shall be maintained within ± 1.5 ppm of the center frequency over a temperature variation of -30°C to +50°C at normal supply voltage, and over a variation in the primary supply voltage of 85 percent to 115 percent of the rated supply voltage at a temperature of 20°C.				

Frequency Stability Configuration Settings

Power Interface Mode # (See Section 2.4)	EUT Configurations Mode # (See Section 2.9)	EUT Operation Mode # (See 2.6)
1,2,3	1	1
Supplementary information: None		

Frequency Stability Test Equipment

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Signal Generator	Agilent	E4438C	MY45095542	2008-11-28	2009-11-28
Spectrum Analyzer	Agilent	E4440A	MY42510388	2009-11-11	2010-11-11
Temperature chamber	NeingYoul	NY-THR	13200		
Temperature Recorder	Yokogawa	HR-332-08-0125		2009-02-17	2010-02-17

Table 7 Frequency Stability Test results

Frequency Stability with variation of Ambient Temperature - Downlink(Forward)

Carrier Band	Temperature (°C)	Assigned Frequency (Hz)	Measured Frequency (Hz)	Drift (ppm)	Limit (ppm)
WCDMA	50	877,500,000.000	877,500,000.005	0.000006	1.0
	40	877,500,000.000	877,499,999.995	-0.000006	1.0
	30	877,500,000.000	877,500,000.003	0.000003	1.0
	20	Reference			
	10	877,500,000.000	877,499,999.997	-0.000003	1.0
	0	877,500,000.000	877,499,999.996	-0.000005	1.0
	-10	877,500,000.000	877,500,000.004	0.000005	1.0
	-20	877,500,000.000	877,500,000.005	0.000006	1.0
	-30	877,500,000.000	877,500,000.007	0.000008	1.0
	50	880,200,000.000	880,199,999.996	-0.000005	1.0
GSM	40	880,200,000.000	880,199,999.997	-0.000003	1.0
	30	880,200,000.000	880,199,999.996	-0.000005	1.0
	20	Reference			
	10	880,200,000.000	880,200,000.004	0.000005	1.0
	0	880,200,000.000	880,199,999.996	-0.000005	1.0
	-10	880,200,000.000	880,199,999.997	-0.000003	1.0
	-20	880,200,000.000	880,199,999.996	-0.000005	1.0
	-30	880,200,000.000	880,199,999.994	-0.000007	1.0

Supplementary information:

- No modulation,
- Before the testing, the signal generator and spectrum analyzer were synchronized by using the external sync. Frequency measurement was made by spectrum analyzer
- Reference input voltage : 120Vac

Frequency Stability with variation of Input voltage

Carrier Band	Input voltage (V)	Assigned Frequency (Hz)	Measured Frequency (Hz)	Drift (ppm)	Limit (ppm)
WCDMA	102 Vac	877,500,000.000	877,500,000.003	0.000003	1.0
	138 Vac	877,500,000.000	877,499,999.995	-0.000006	1.0
GSM	102 Vac	880,200,000.000	880,199,999.996	-0.000005	1.0
	138 Vac	880,200,000.000	880,200,000.003	0.000003	1.0

Supplementary information:

- No modulation,
- Before the testing, the signal generator and spectrum analyzer were synchronized by using the external sync. Frequency measurement was made by spectrum analyzer
- Reference temperature : 20°C

Result of test

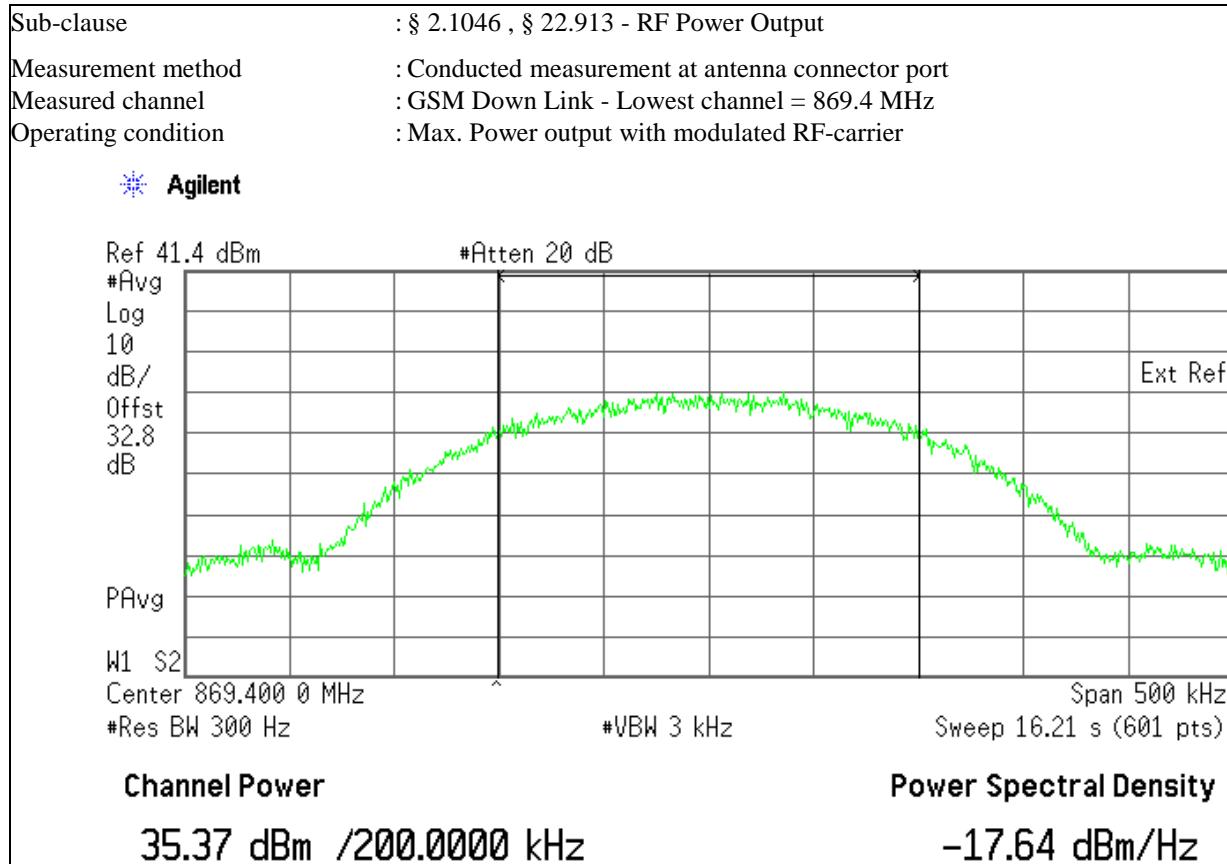
In accordance with Technical requirement of FCC Rules section 47 CFR § 2.1055, § 22.355

Complied

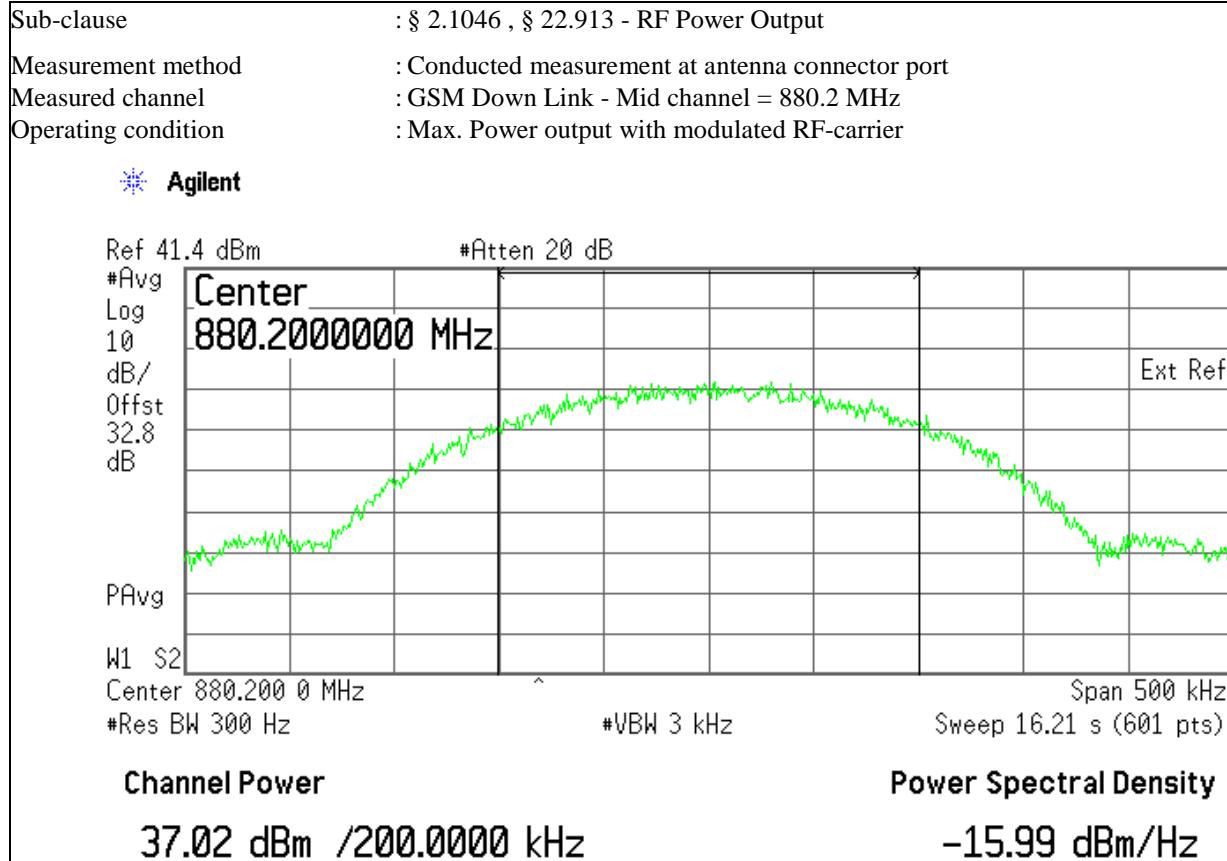
Failed

Annex 1. Measurement Plots

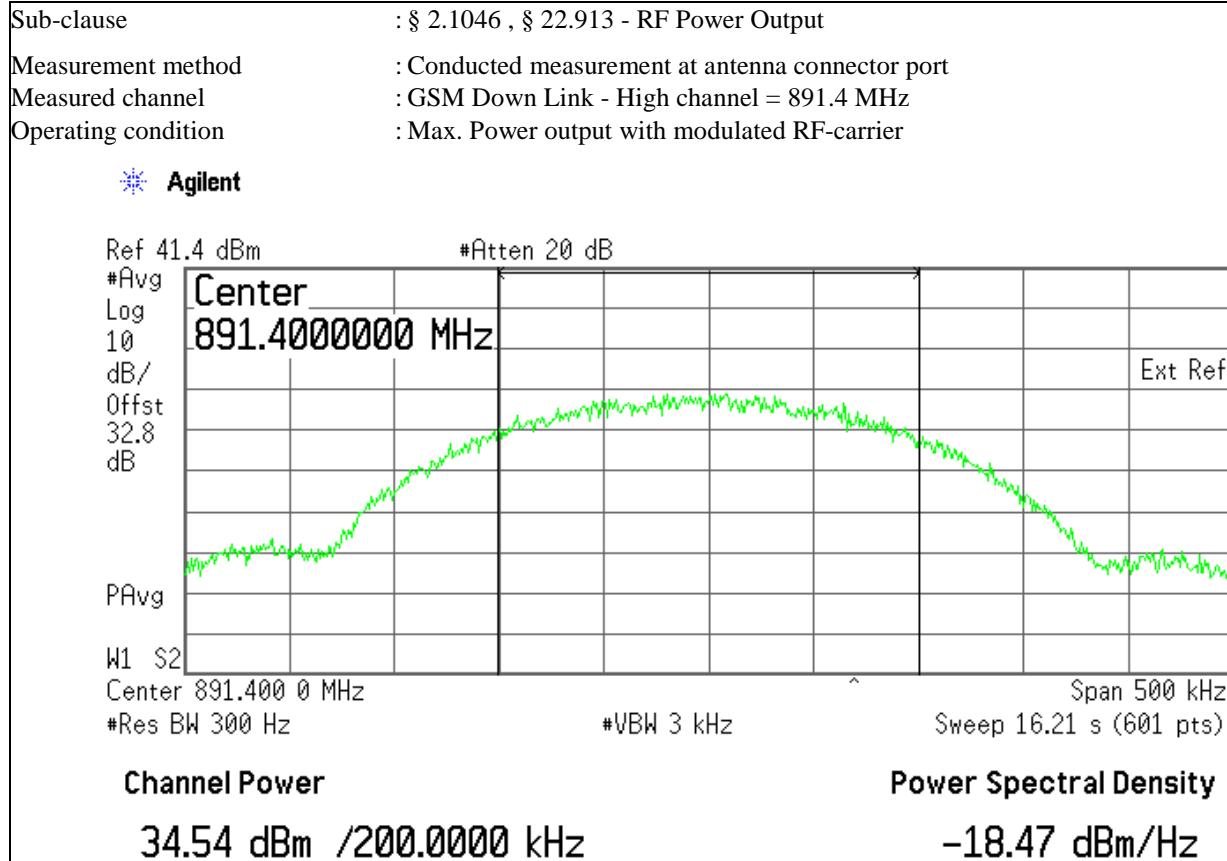
A1. Measurement result – Plot no. 1



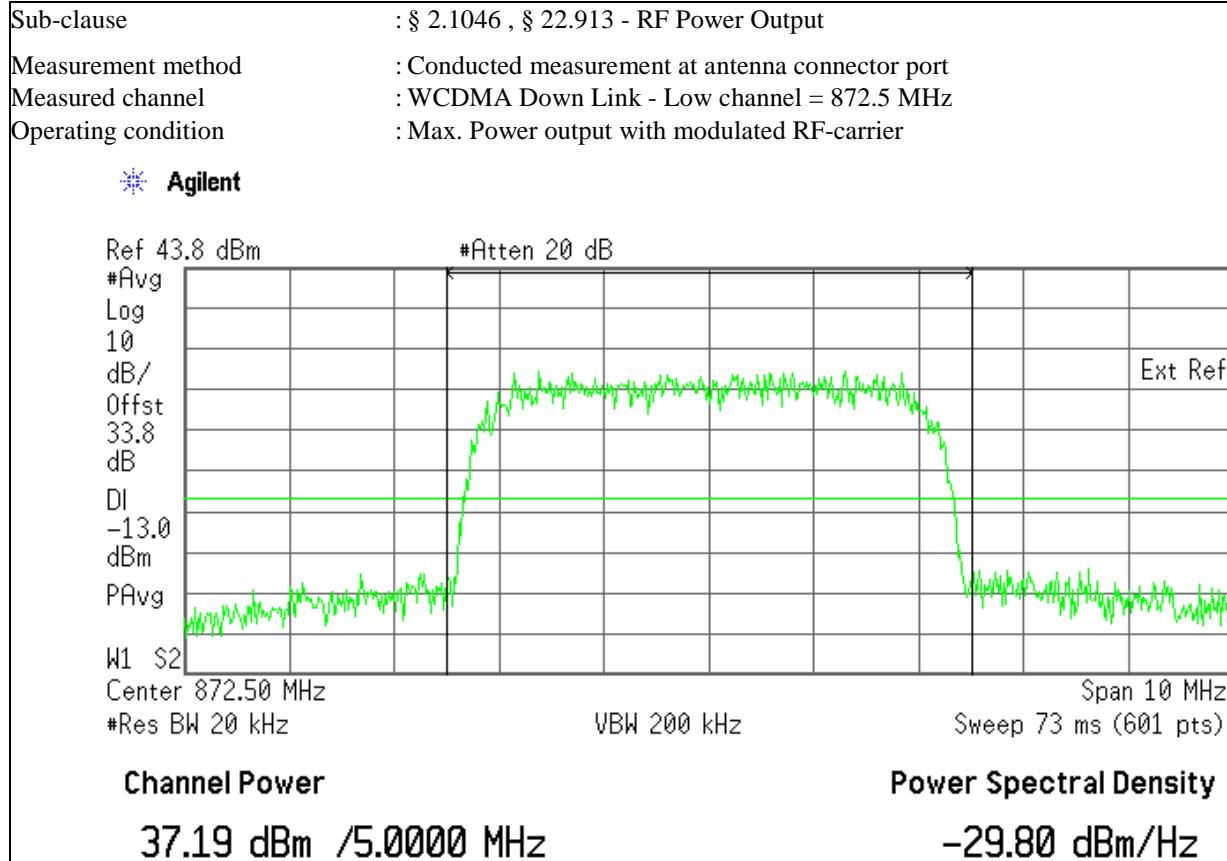
A1. Measurement result – Plot no. 2



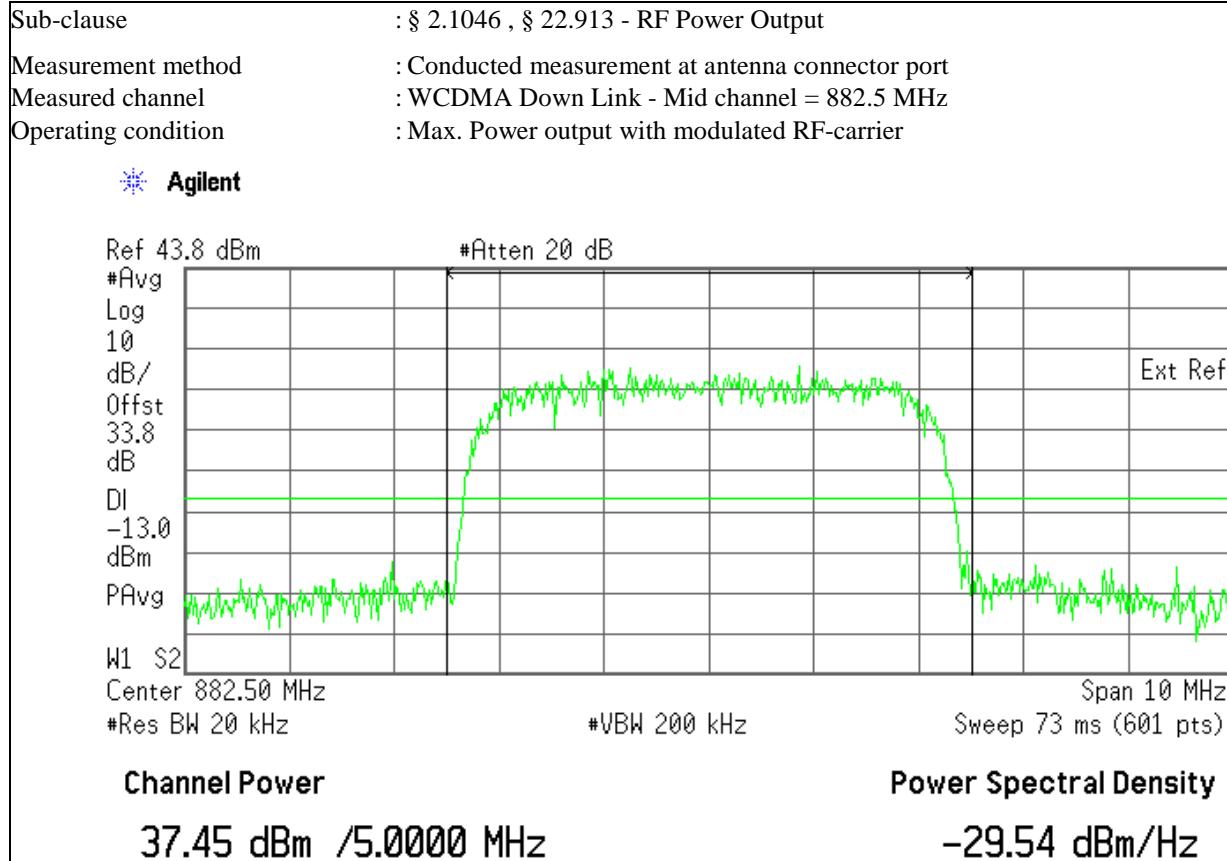
A1. Measurement result – Plot no. 3



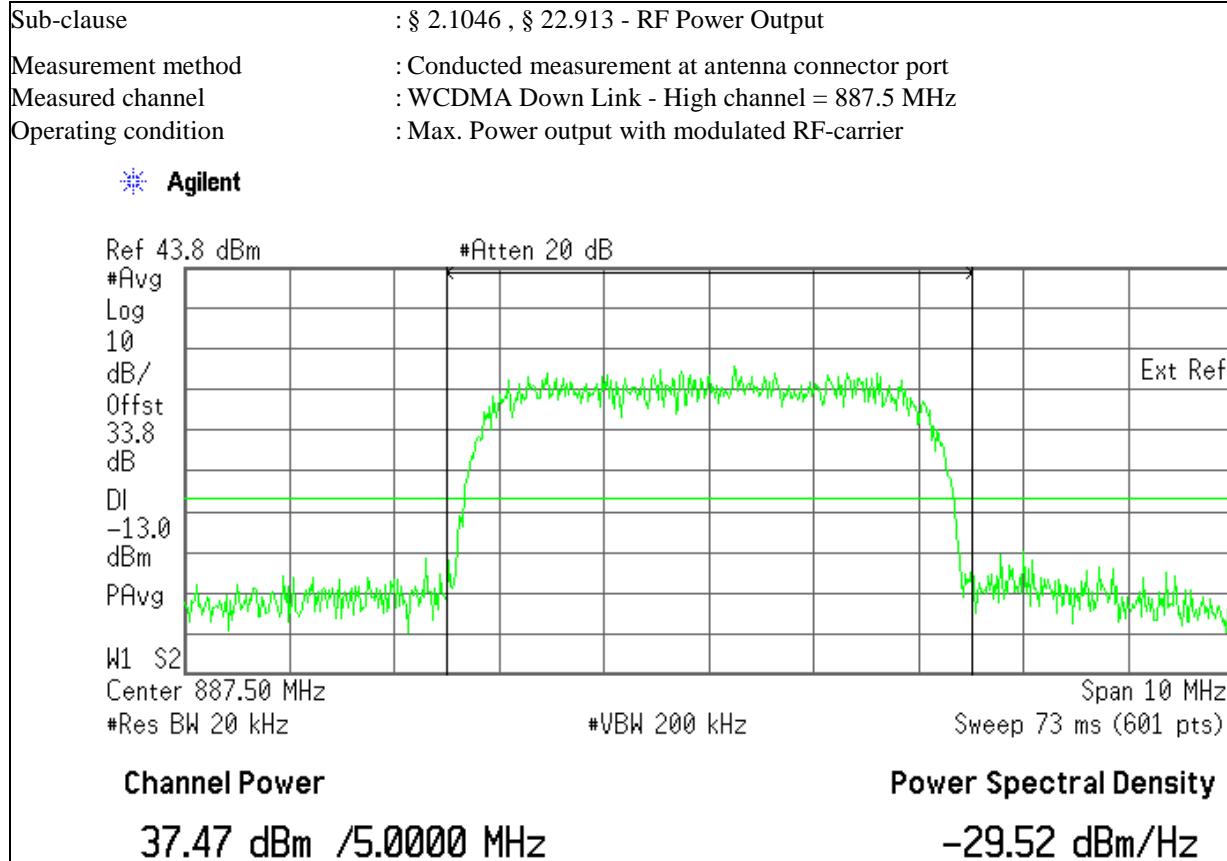
A1. Measurement result – Plot no. 4



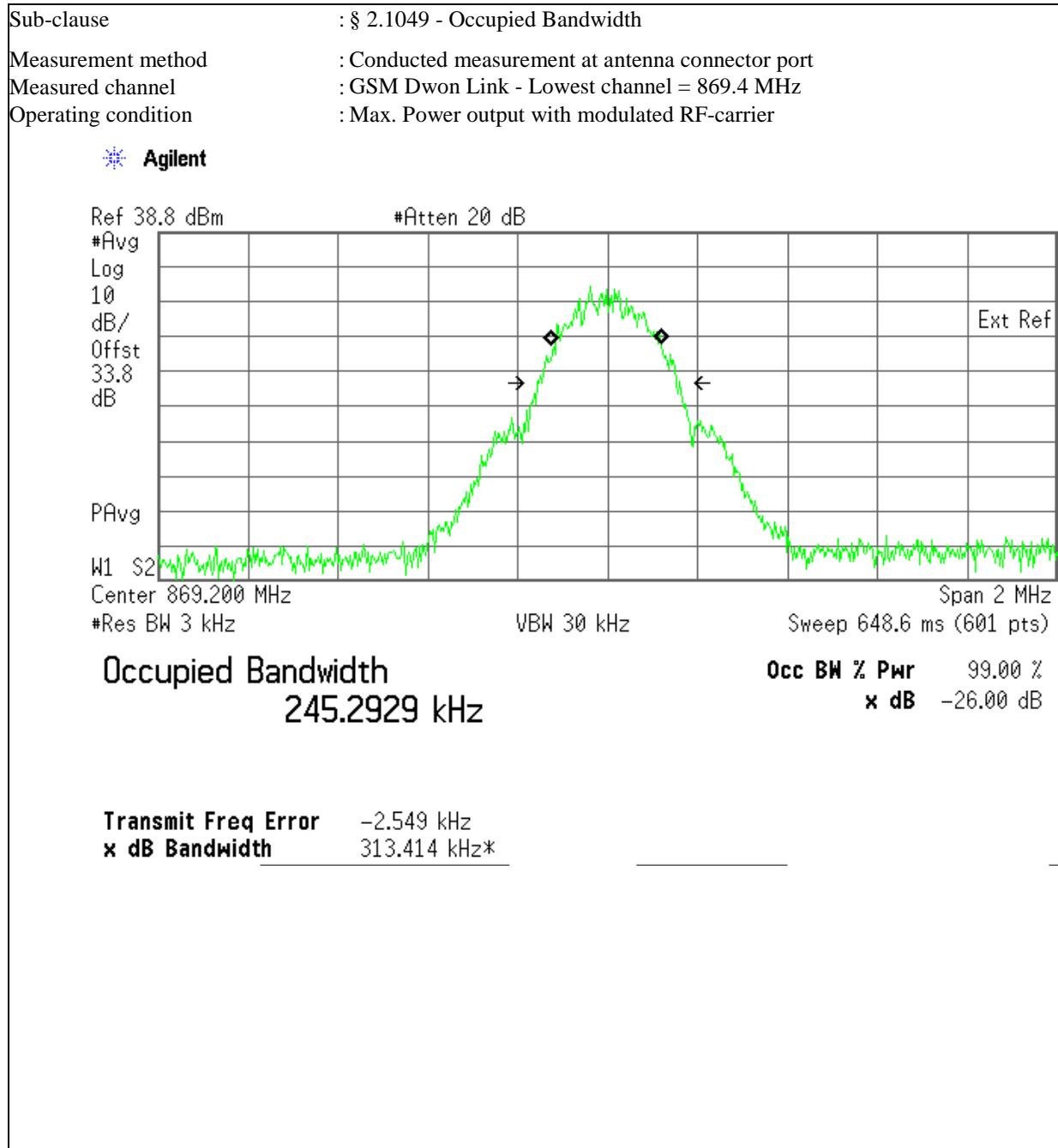
A1. Measurement result – Plot no. 5



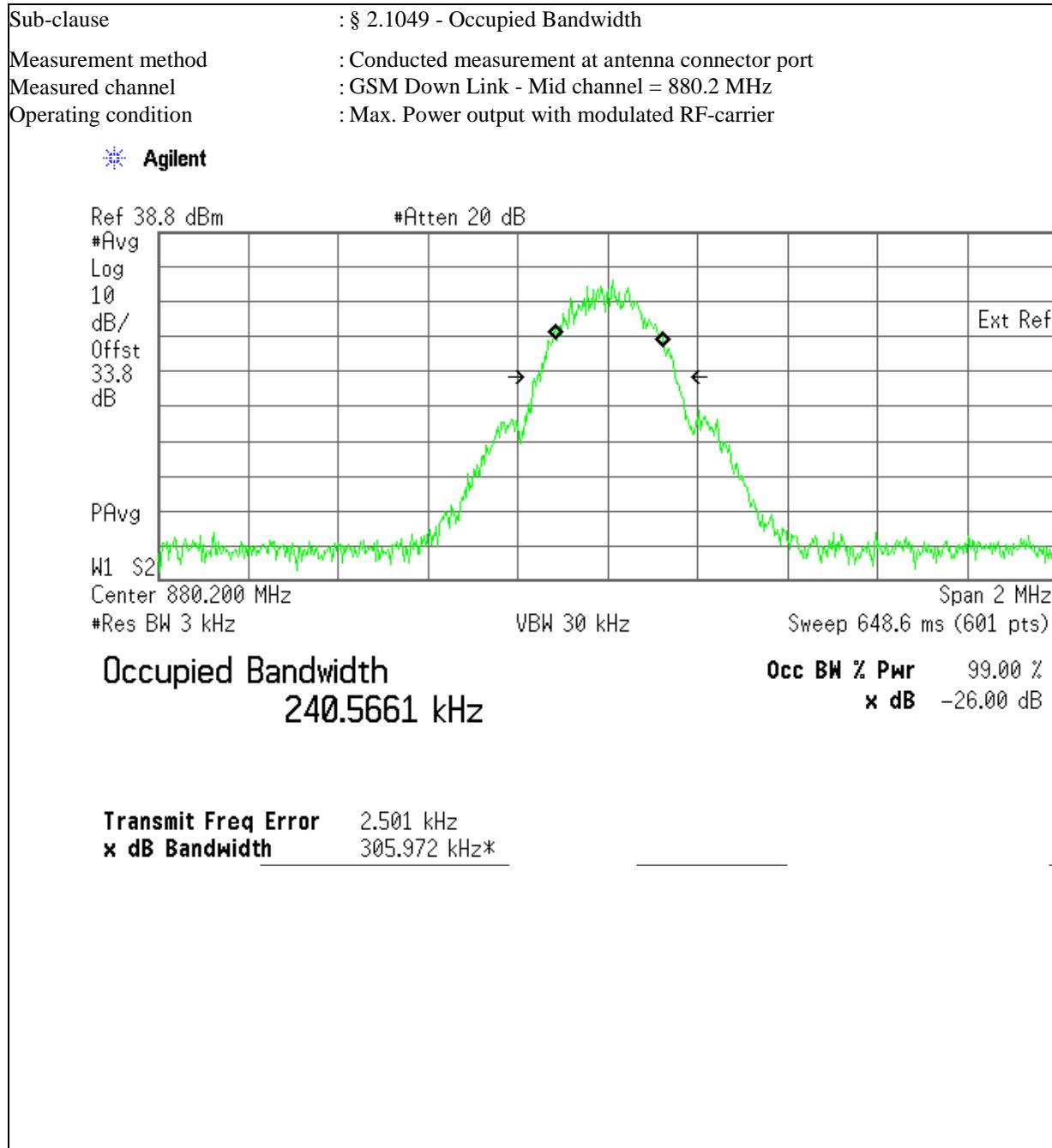
A1. Measurement result – Plot no. 6



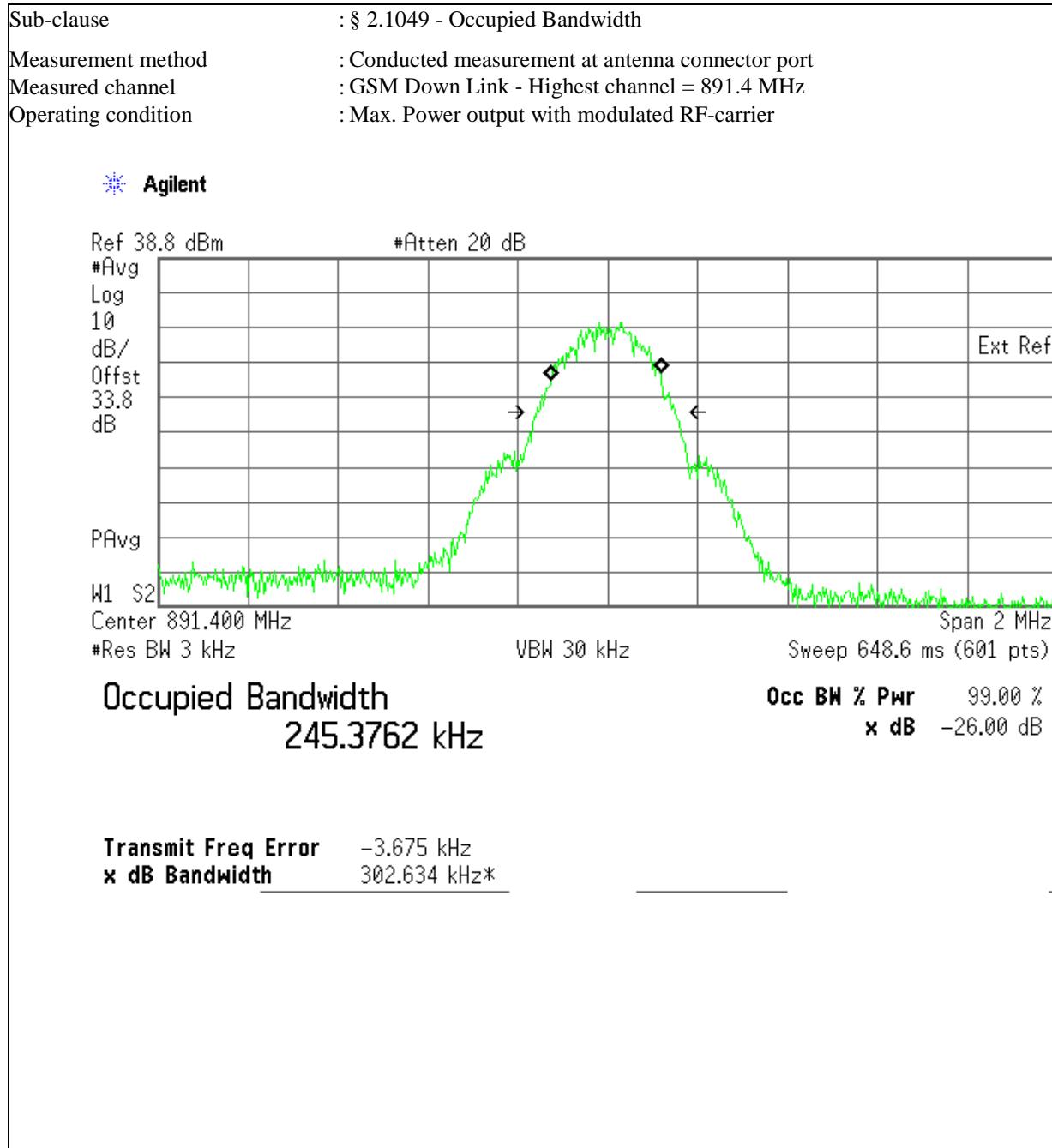
A1. Measurement result – Plot no. 7



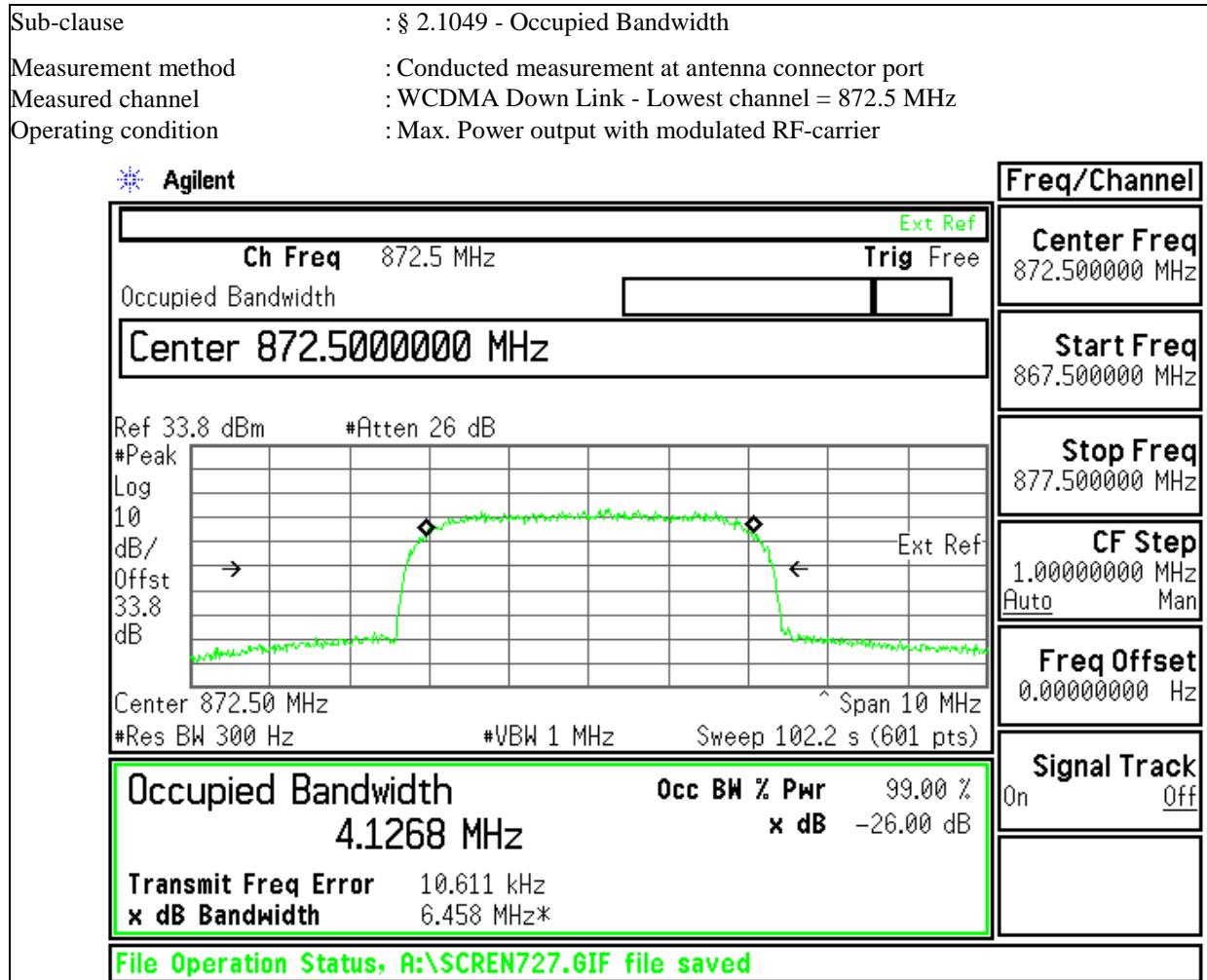
A1. Measurement result – Plot no. 8



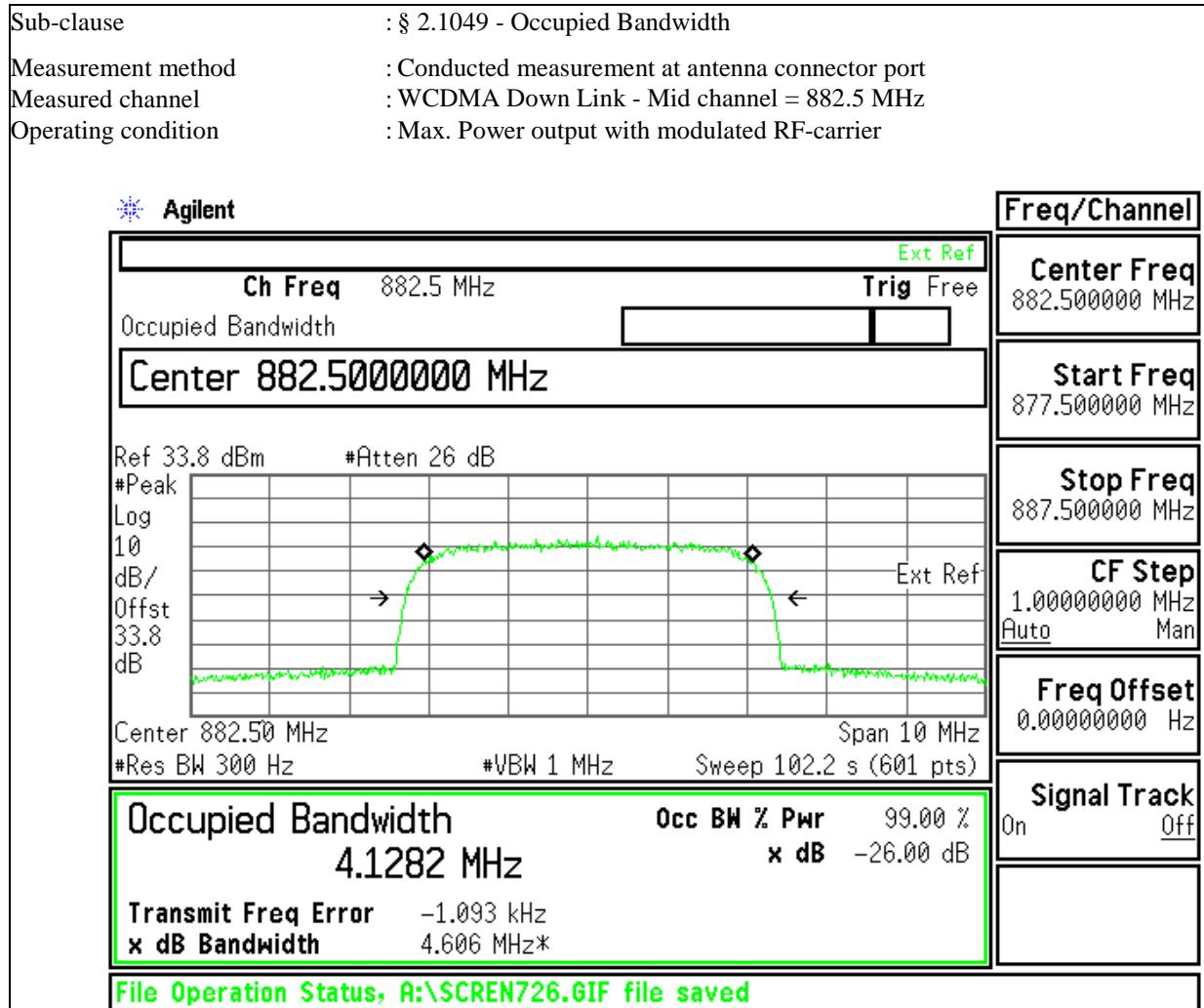
A1. Measurement result – Plot no. 9



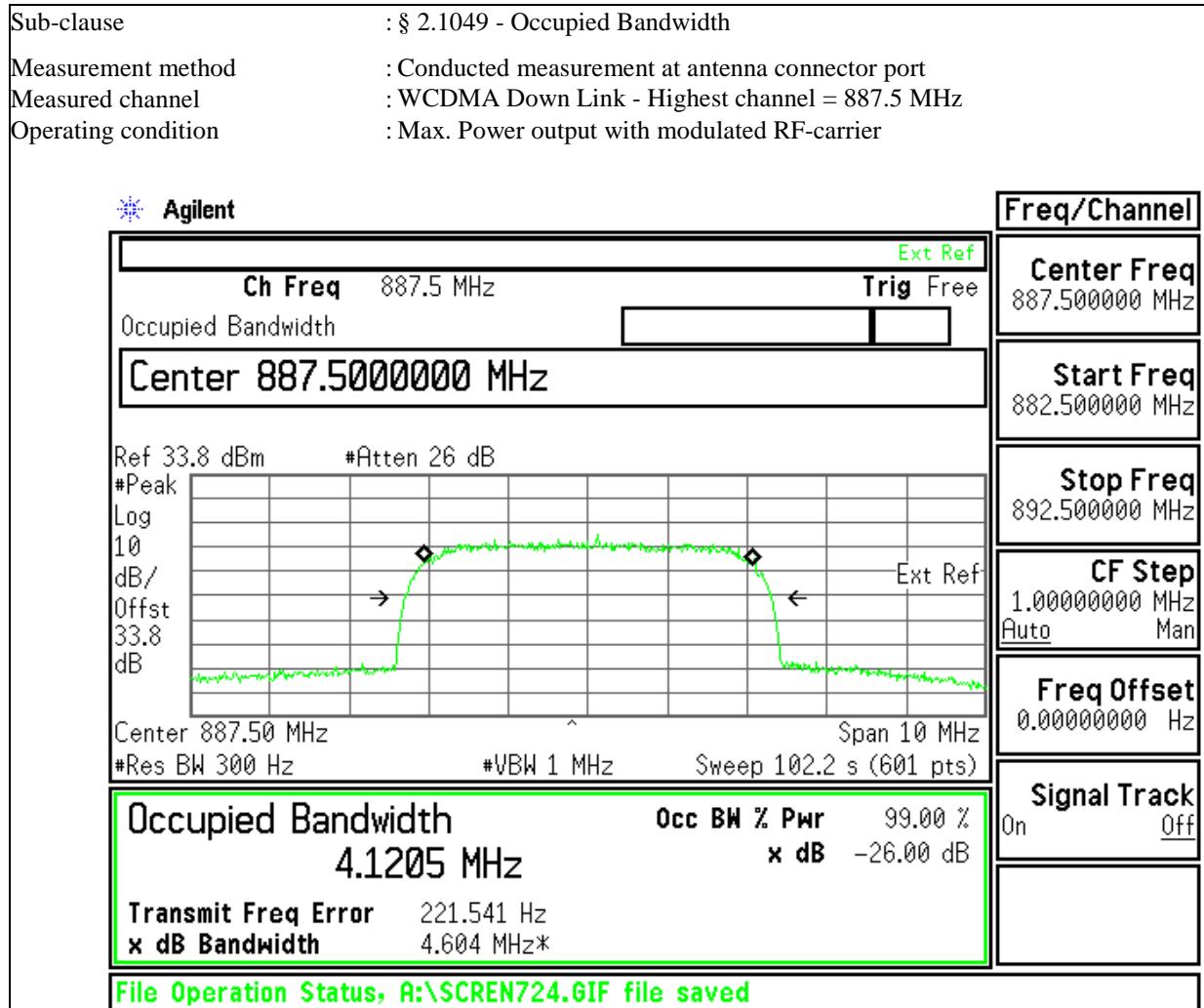
A1. Measurement result – Plot no. 10



A1. Measurement result – Plot no. 11



A1. Measurement result – Plot no. 12



A1. Measurement result – Plot no. 13

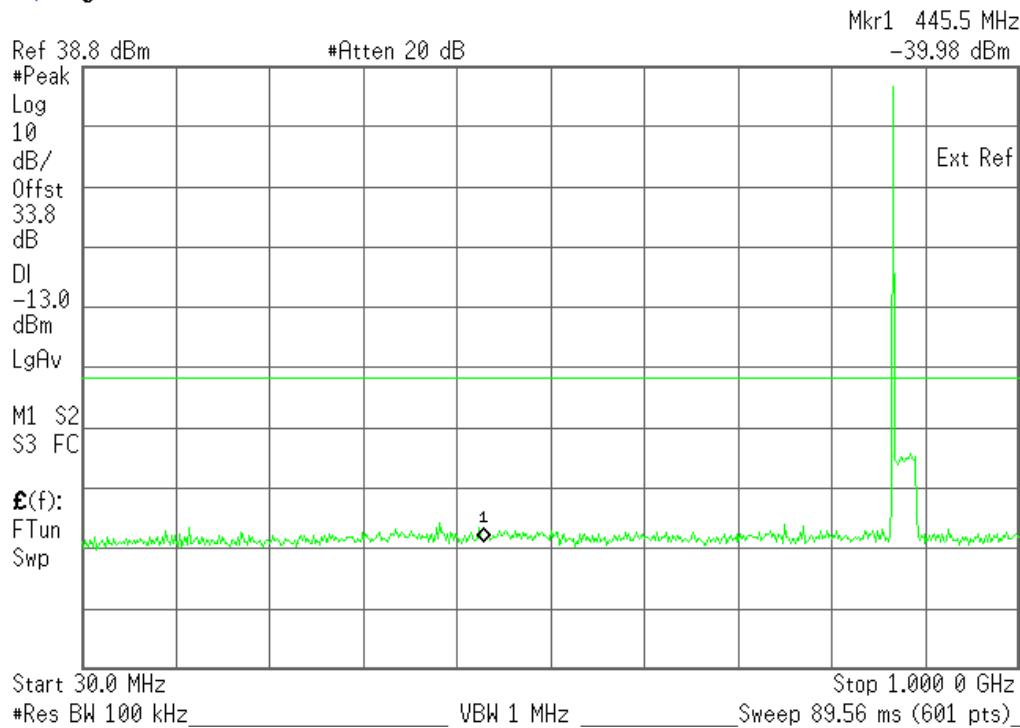
Sub-clause : § 2.1051 , § 22.917 - Spurious Emissions at Antenna terminal

Measurement method : Conducted measurement at antenna connector port

Measured channel : GSM Down Link - Lowest channel = 869.4 MHz

Operating condition : Max. Power output with modulated RF-carrier

 Agilent



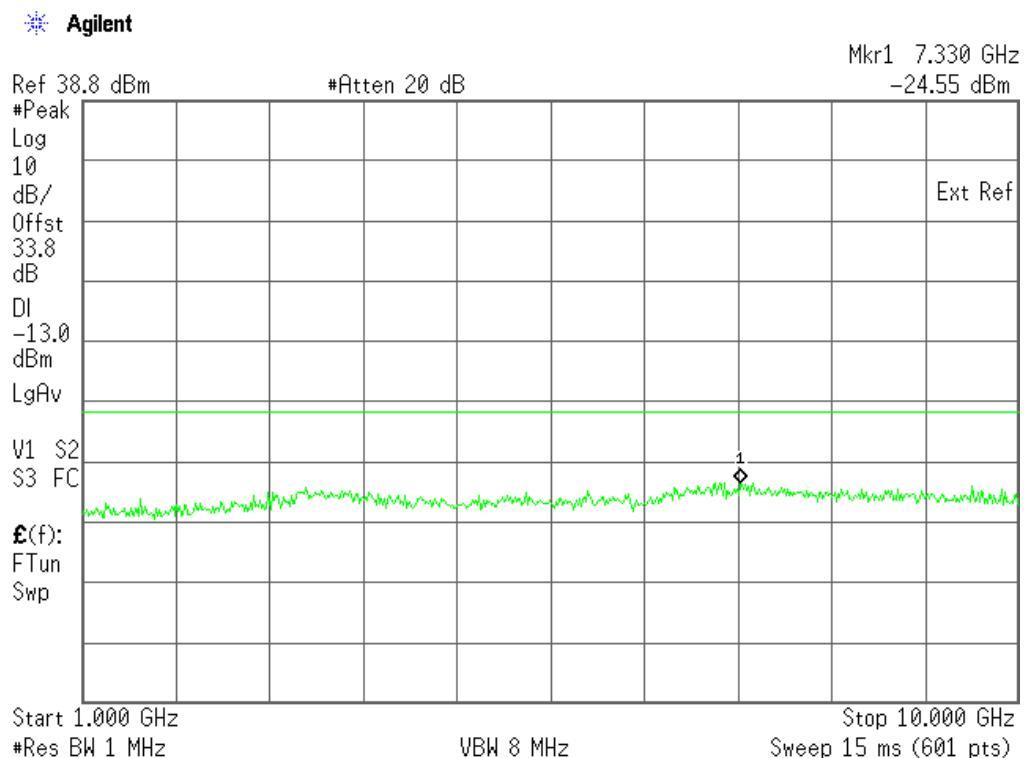
A1. Measurement result – Plot no. 14

Sub-clause : § 2.1051 , § 22.917 - Spurious Emissions at Antenna terminal

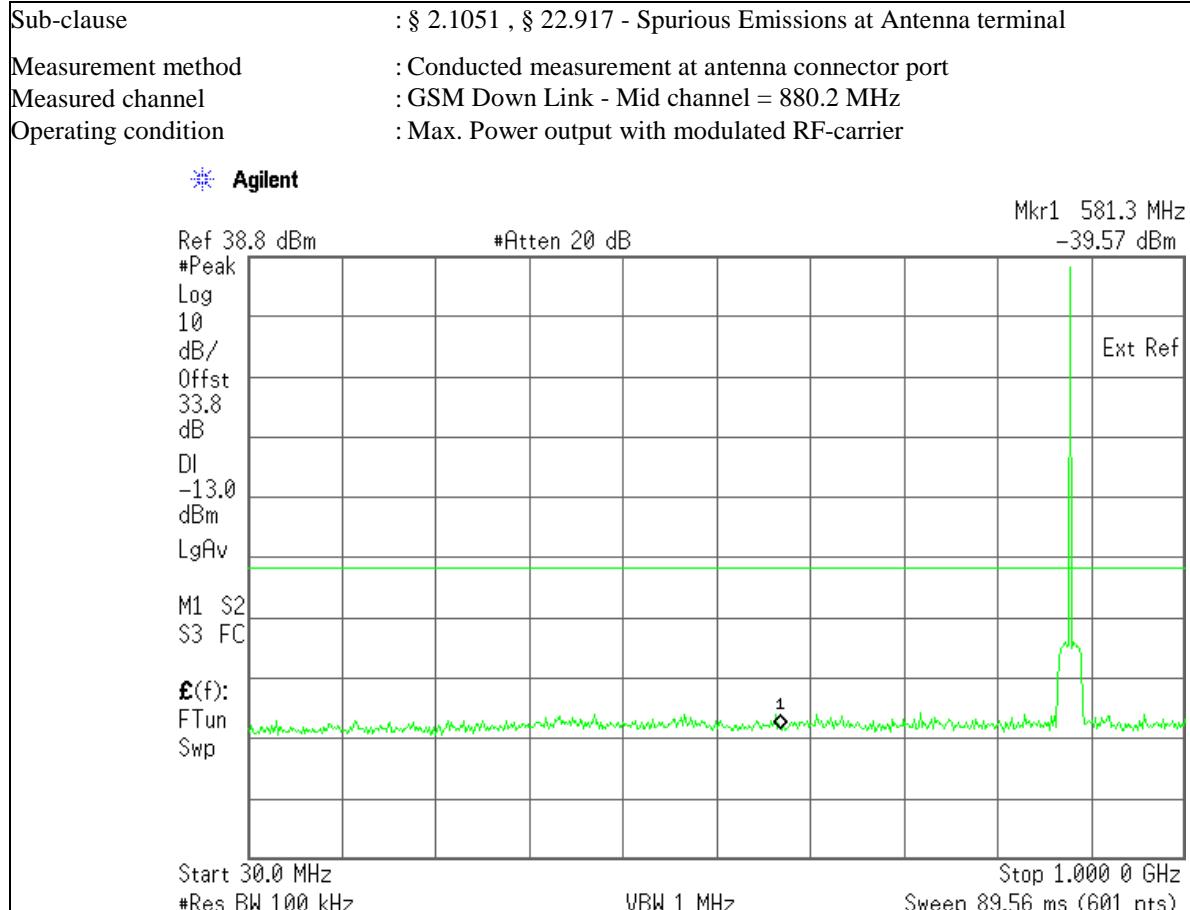
Measurement method : Conducted measurement at antenna connector port

Measured channel : GSM Down Link - Lowest channel = 869.4 MHz

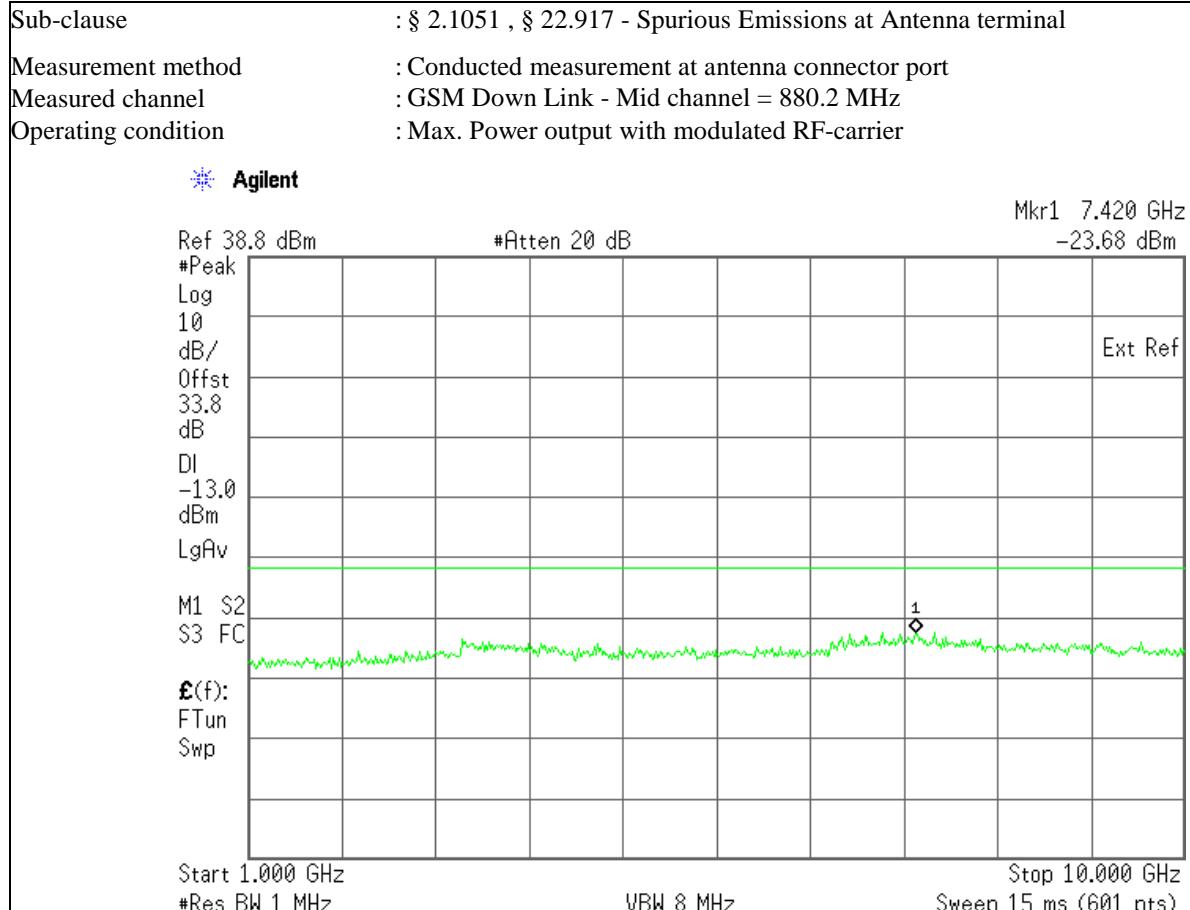
Operating condition : Max. Power output with modulated RF-carrier



A1. Measurement result – Plot no. 15



A1. Measurement result – Plot no. 16



A1. Measurement result – Plot no. 17

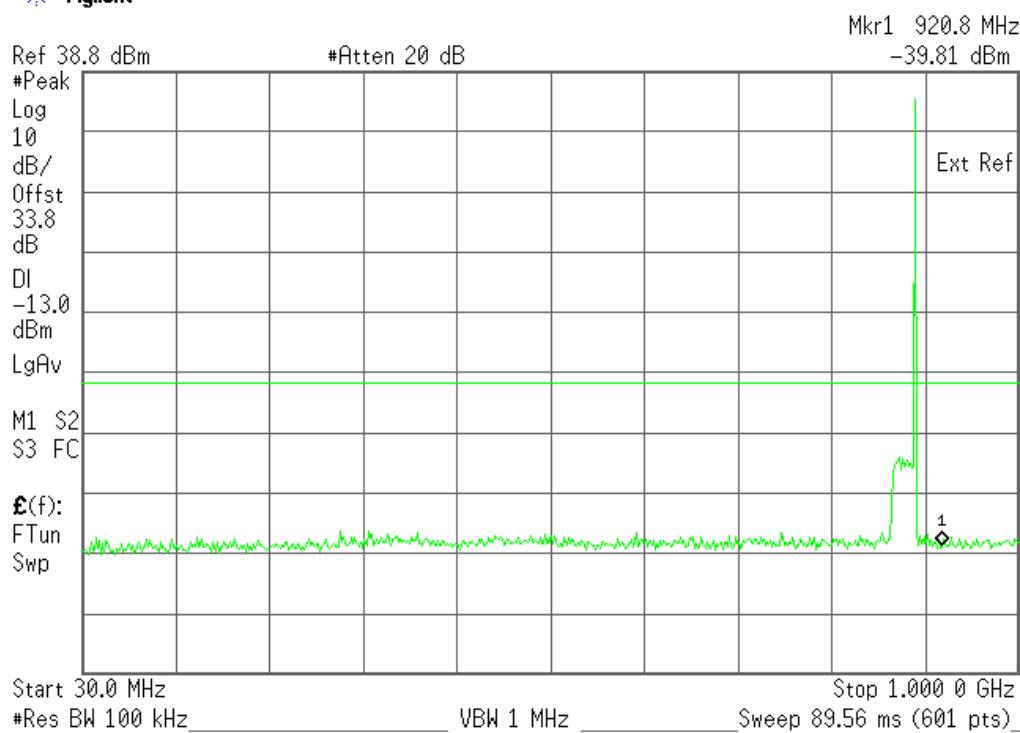
Sub-clause : § 2.1051 , § 22.917 - Spurious Emissions at Antenna terminal

Measurement method : Conducted measurement at antenna connector port

Measured channel : GSM Down Link - High channel = 891.4 MHz

Operating condition : Max. Power output with modulated RF-carrier

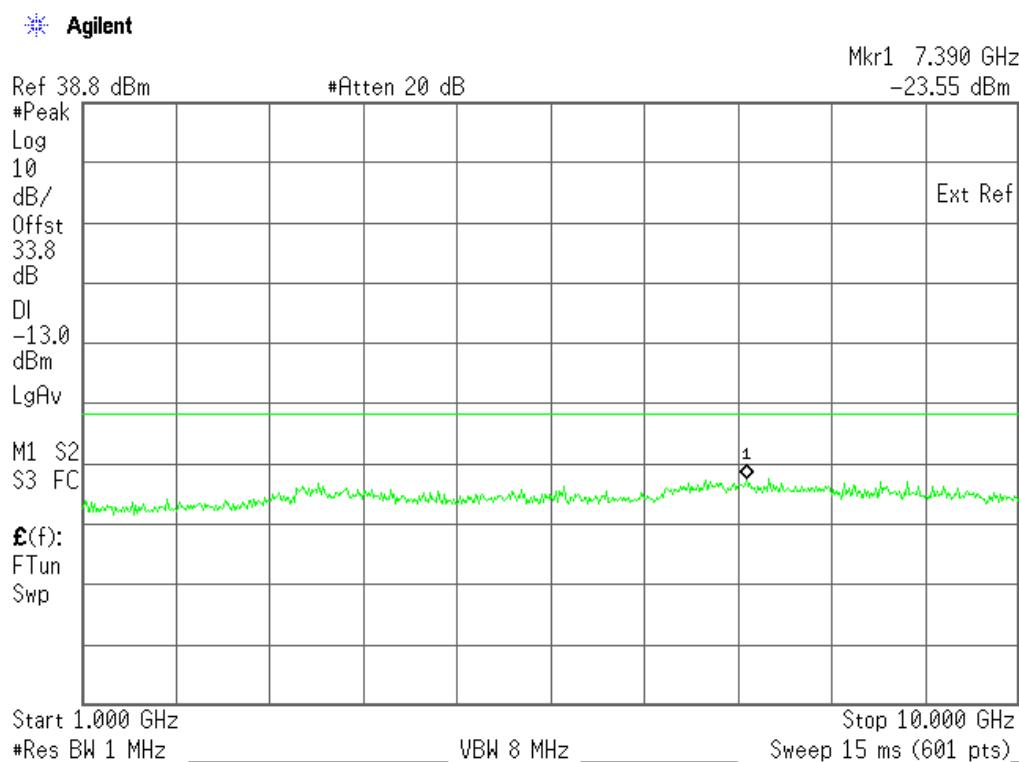
 Agilent



A1. Measurement result – Plot no. 18

Sub-clause : § 2.1051 , § 22.917 - Spurious Emissions at Antenna terminal

Measurement method	: Conducted measurement at antenna connector port
Measured channel	: GSM Down Link - High channel = 891.4 MHz
Operating condition	: Max. Power output with modulated RF-carrier



A1. Measurement result – Plot no. 19

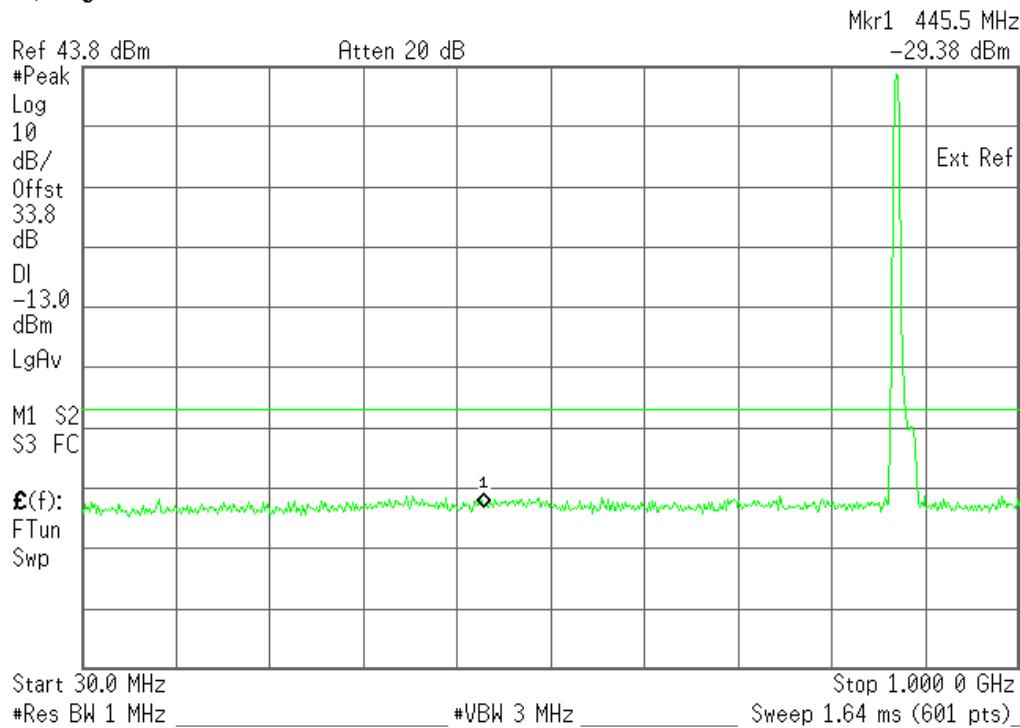
Sub-clause : § 2.1051 , § 22.917 - Spurious Emissions at Antenna terminal

Measurement method : Conducted measurement at antenna connector port

Measured channel : WCDMA Down Link - Low channel = 872.5 MHz

Operating condition : Max. Power output with modulated RF-carrier

 Agilent



A1. Measurement result – Plot no. 20

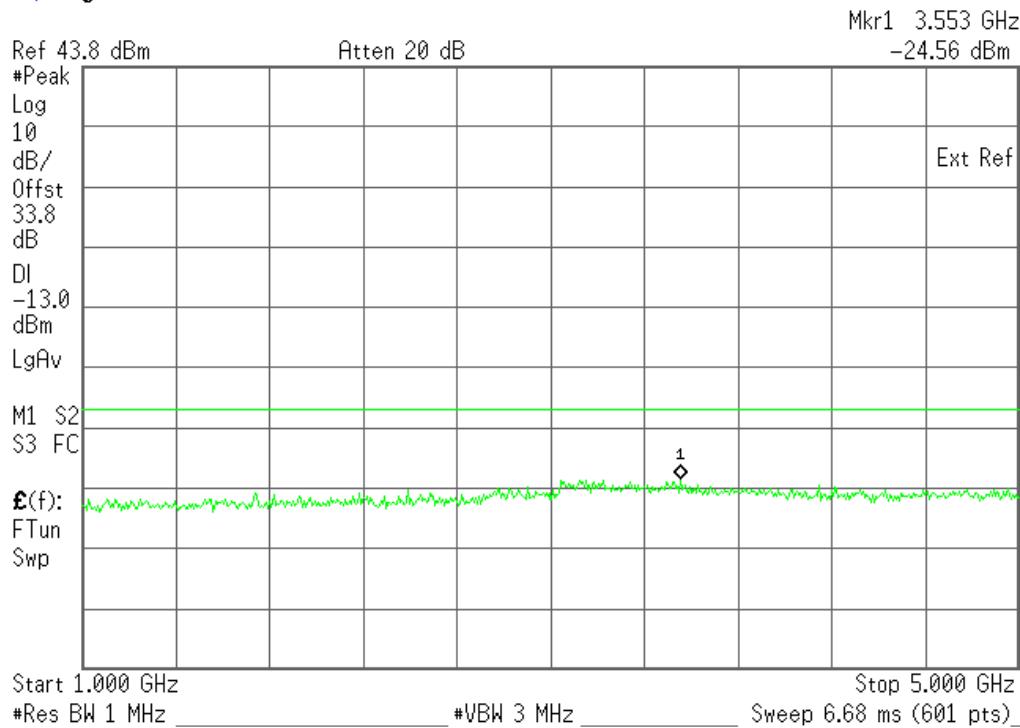
Sub-clause : § 2.1051 , § 22.917 - Spurious Emissions at Antenna terminal

Measurement method : Conducted measurement at antenna connector port

Measured channel : WCDMA Down Link - Low channel = 872.5 MHz

Operating condition : Max. Power output with modulated RF-carrier

 Agilent



A1. Measurement result – Plot no. 21

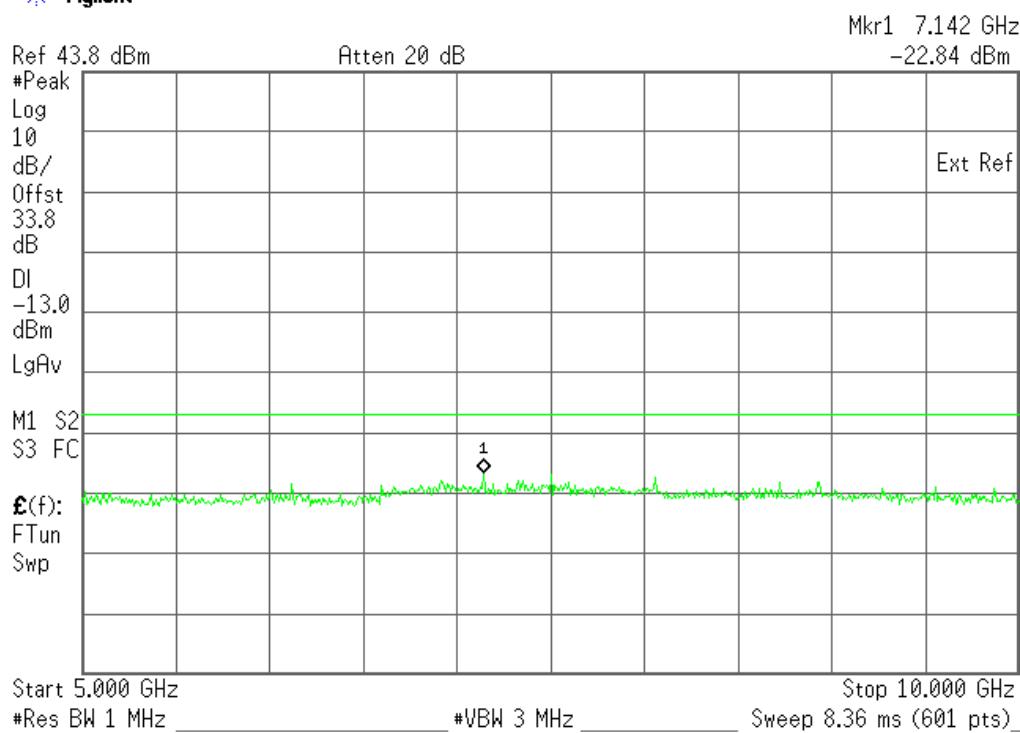
Sub-clause : § 2.1051 , § 22.917 - Spurious Emissions at Antenna terminal

Measurement method : Conducted measurement at antenna connector port

Measured channel : WCDMA Down Link - Low channel = 872.5 MHz

Operating condition : Max. Power output with modulated RF-carrier

 Agilent



A1. Measurement result – Plot no. 22

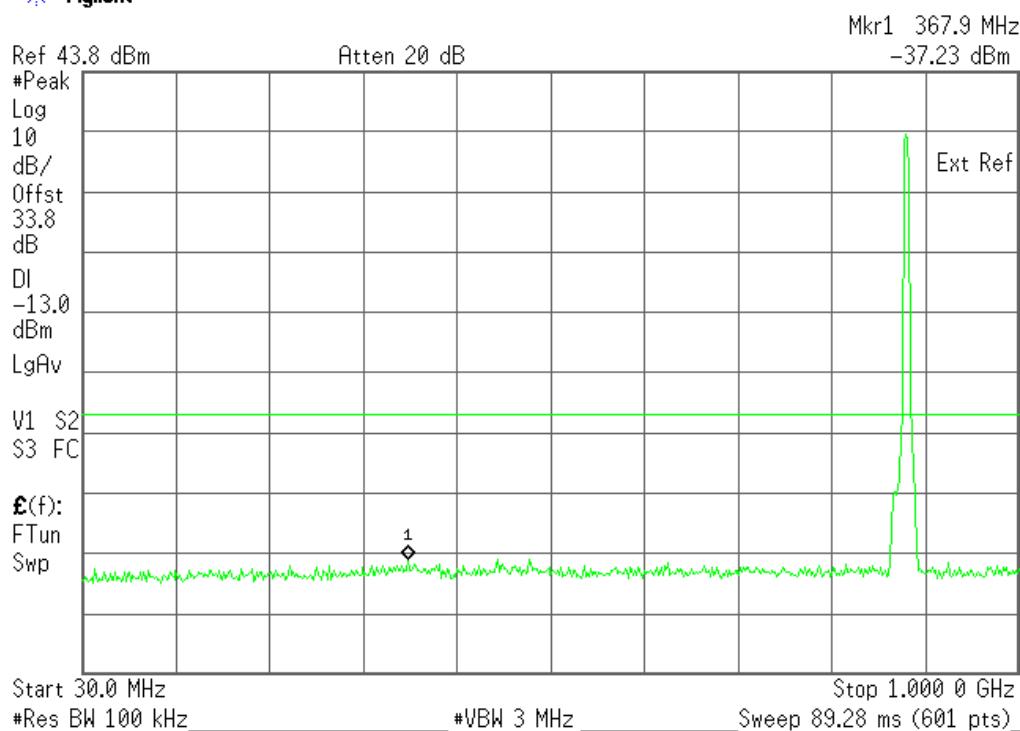
Sub-clause : § 2.1051 , § 22.917 - Spurious Emissions at Antenna terminal

Measurement method : Conducted measurement at antenna connector port

Measured channel : WCDMA Down Link - Mid channel = 882.5 MHz

Operating condition : Max. Power output with modulated RF-carrier

 Agilent



A1. Measurement result – Plot no. 23

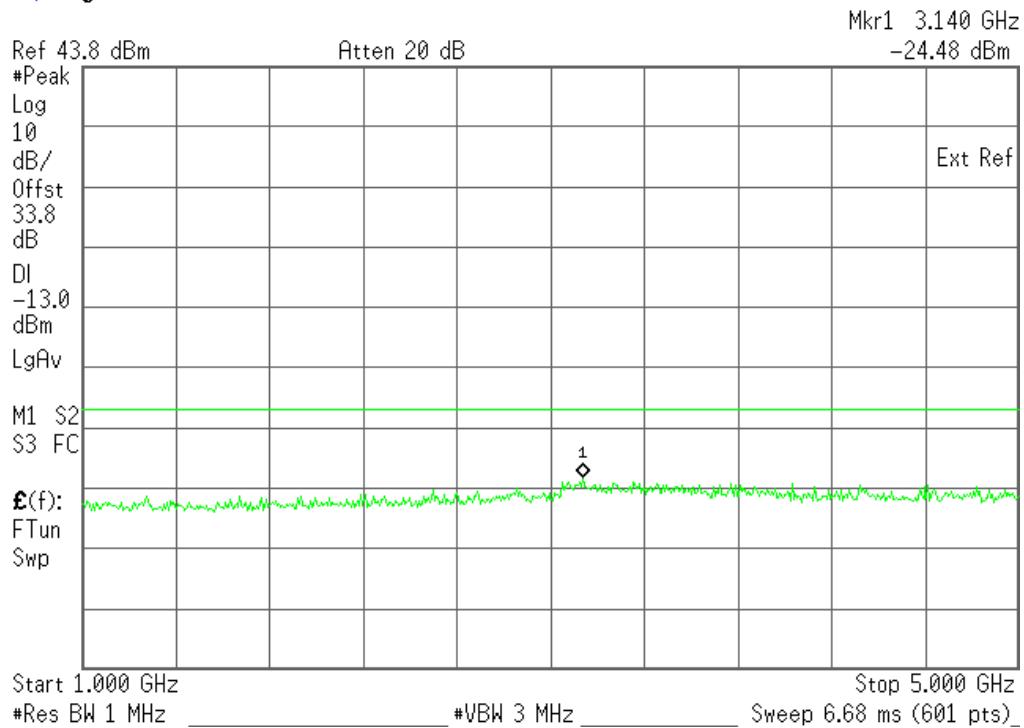
Sub-clause : § 2.1051 , § 22.917 - Spurious Emissions at Antenna terminal

Measurement method : Conducted measurement at antenna connector port

Measured channel : WCDMA Down Link - Mid channel = 882.5 MHz

Operating condition : Max. Power output with modulated RF-carrier

 Agilent



A1. Measurement result – Plot no. 24

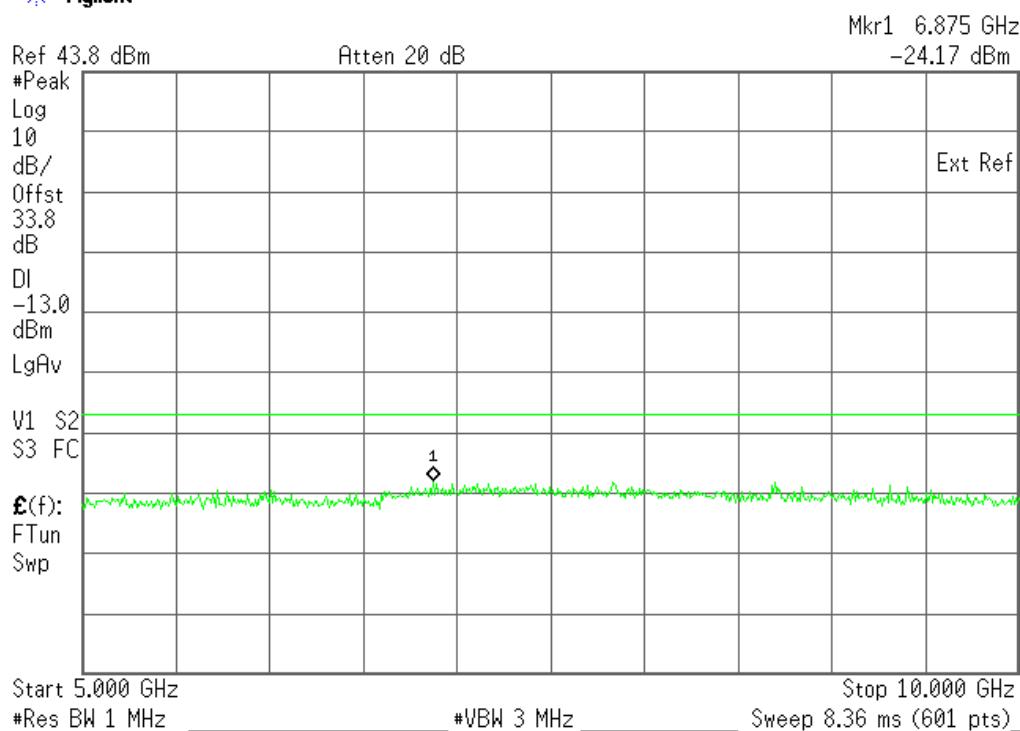
Sub-clause : § 2.1051 , § 22.917 - Spurious Emissions at Antenna terminal

Measurement method : Conducted measurement at antenna connector port

Measured channel : WCDMA Down Link - Mid channel = 882.5 MHz

Operating condition : Max. Power output with modulated RF-carrier

 Agilent



A1. Measurement result – Plot no. 25

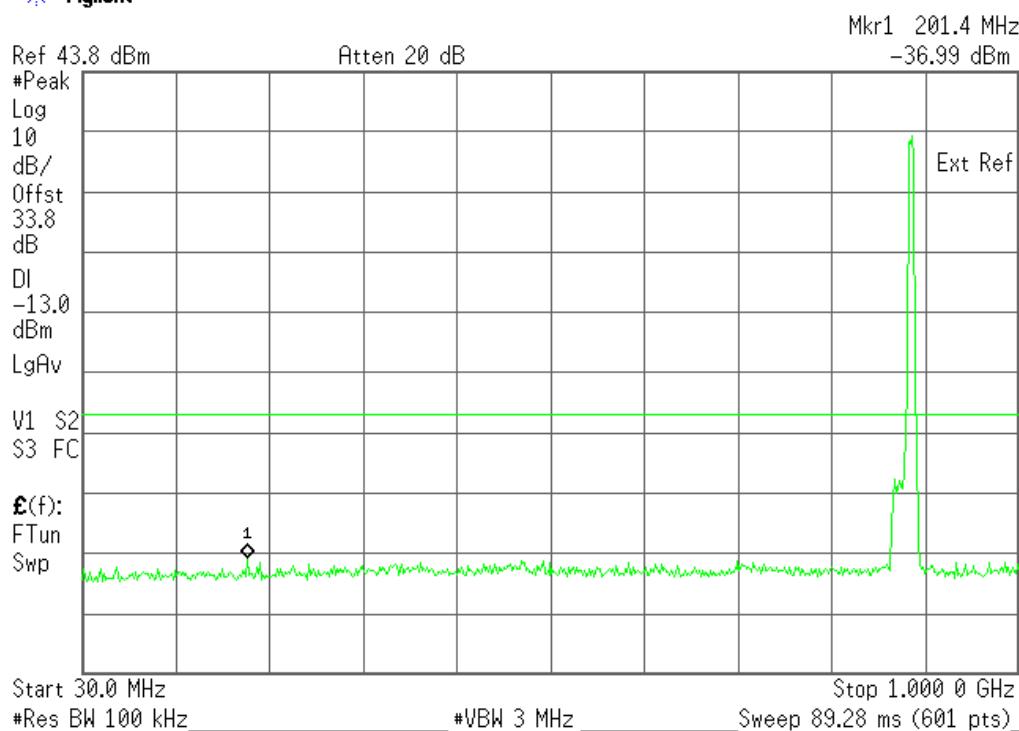
Sub-clause : § 2.1051 , § 22.917 - Spurious Emissions at Antenna terminal

Measurement method : Conducted measurement at antenna connector port

Measured channel : WCDMA Down Link - High channel = 887.5 MHz

Operating condition : Max. Power output with modulated RF-carrier

 Agilent



A1. Measurement result – Plot no. 26

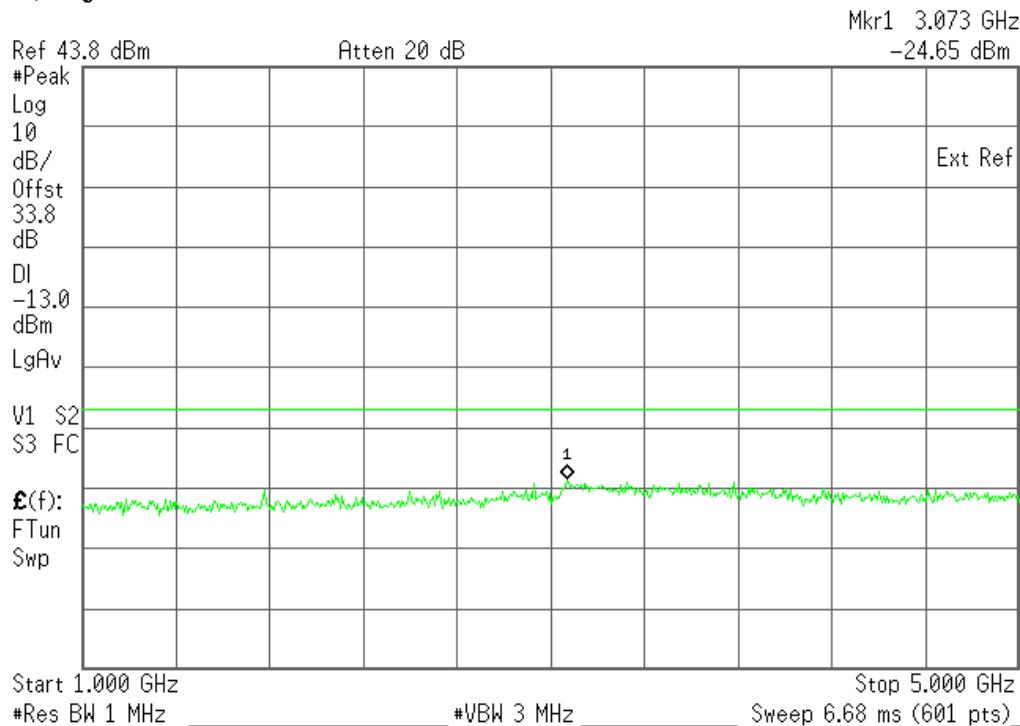
Sub-clause : § 2.1051 , § 22.917 - Spurious Emissions at Antenna terminal

Measurement method : Conducted measurement at antenna connector port

Measured channel : WCDMA Down Link - High channel = 887.5 MHz

Operating condition : Max. Power output with modulated RF-carrier

 Agilent



A1. Measurement result – Plot no. 27

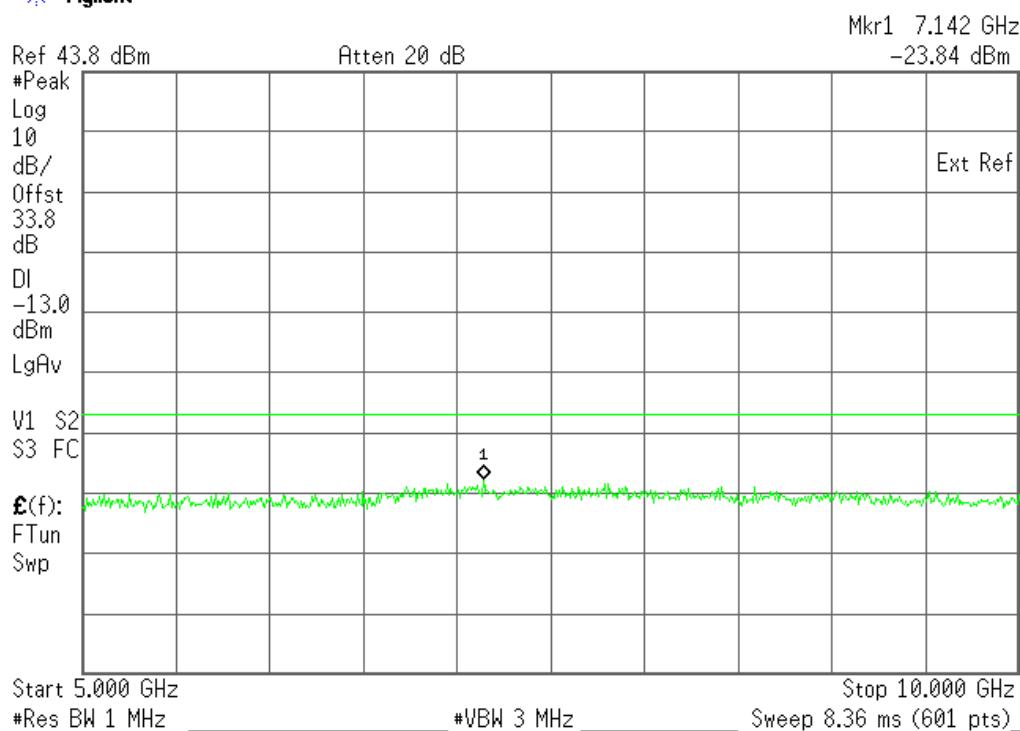
Sub-clause : § 2.1051 , § 22.917 - Spurious Emissions at Antenna terminal

Measurement method : Conducted measurement at antenna connector port

Measured channel : WCDMA Down Link - High channel = 887.5 MHz

Operating condition : Max. Power output with modulated RF-carrier

 Agilent



A1. Measurement result – Plot no. 28

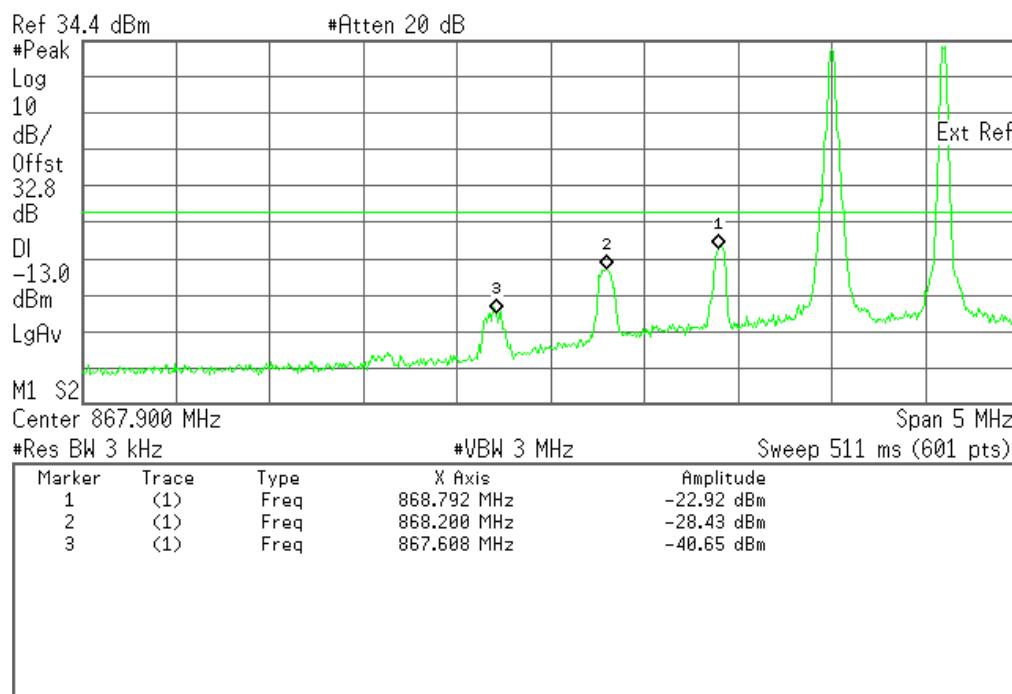
Sub-clause : § 2.1051 , § 22.917 - Spurious Emissions at Antenna terminal

Measurement method : Input Intermodulation

Measured channel : GSM Down Link – Lower N & N+2 order channel input(N = ch no. 129)

Operating condition : Max. Power output with modulated RF-carrier

 Agilent



A1. Measurement result – Plot no. 29

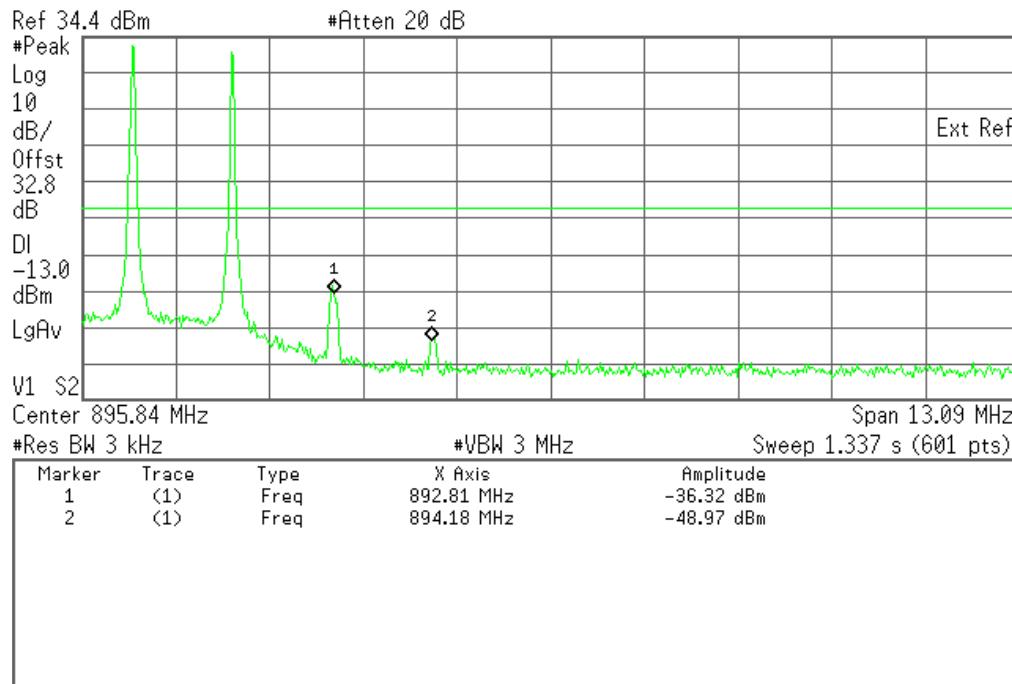
Sub-clause : § 2.1051 , § 22.917 - Spurious Emissions at Antenna terminal

Measurement method : Input Intermodulation

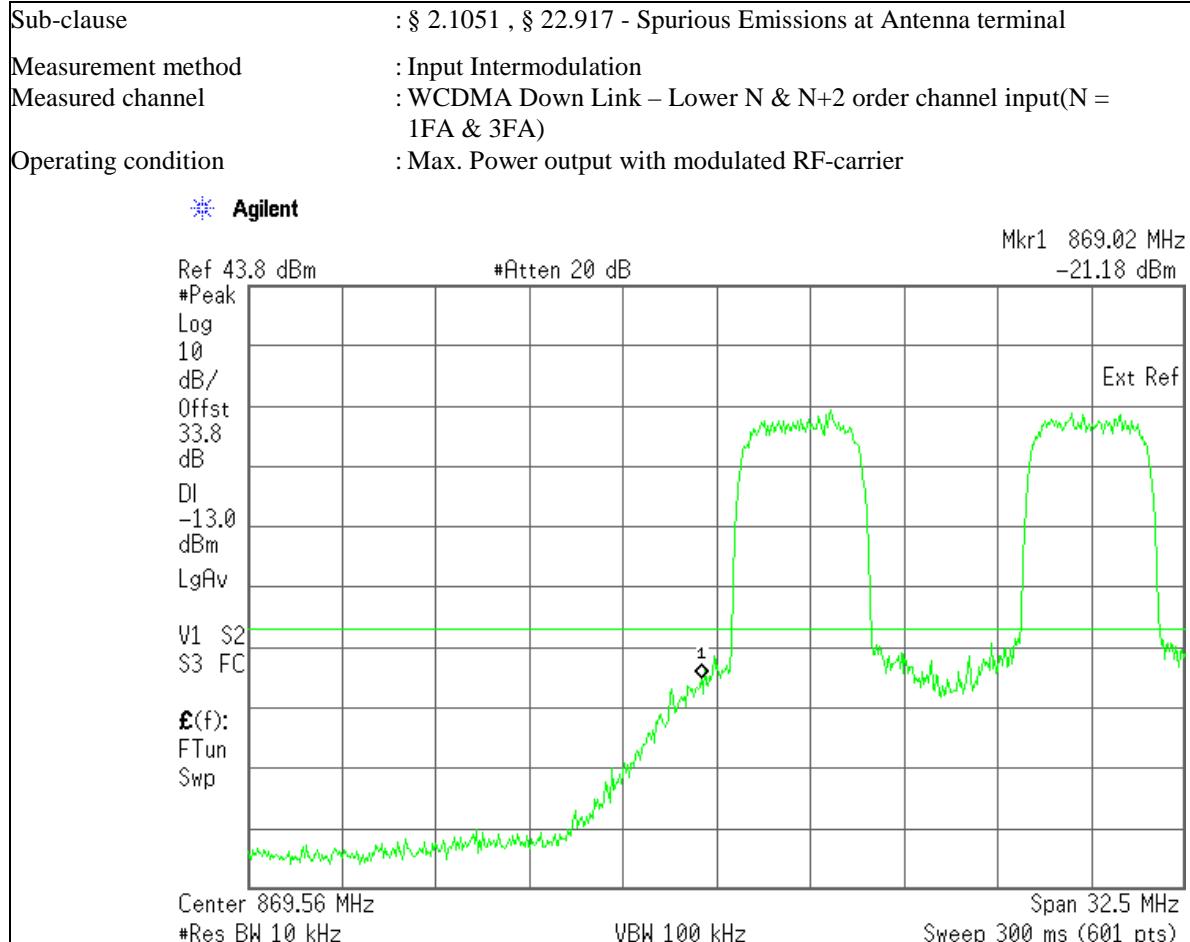
Measured channel : GSM Down Link – Higher N-2 & N order channel input (N; ch no 239)

Operating condition : Max. Power output with modulated RF-carrier

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A1. Measurement result – Plot no. 30



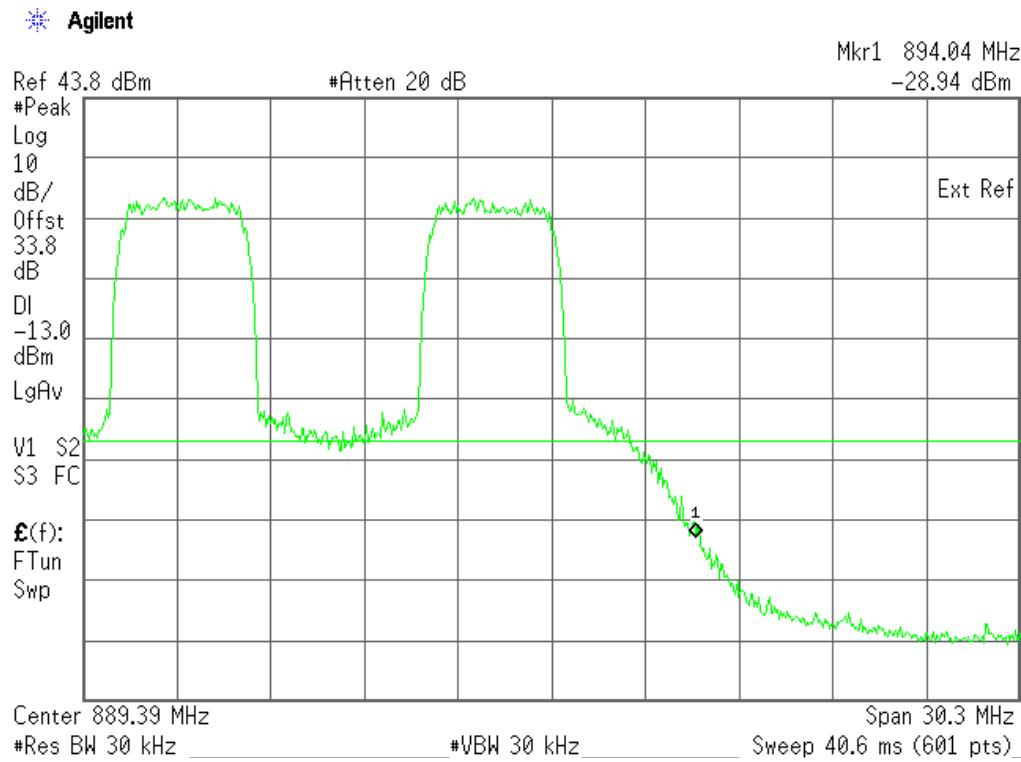
A1. Measurement result – Plot no.31

Sub-clause : § 2.1051 , § 22.917 - Spurious Emissions at Antenna terminal

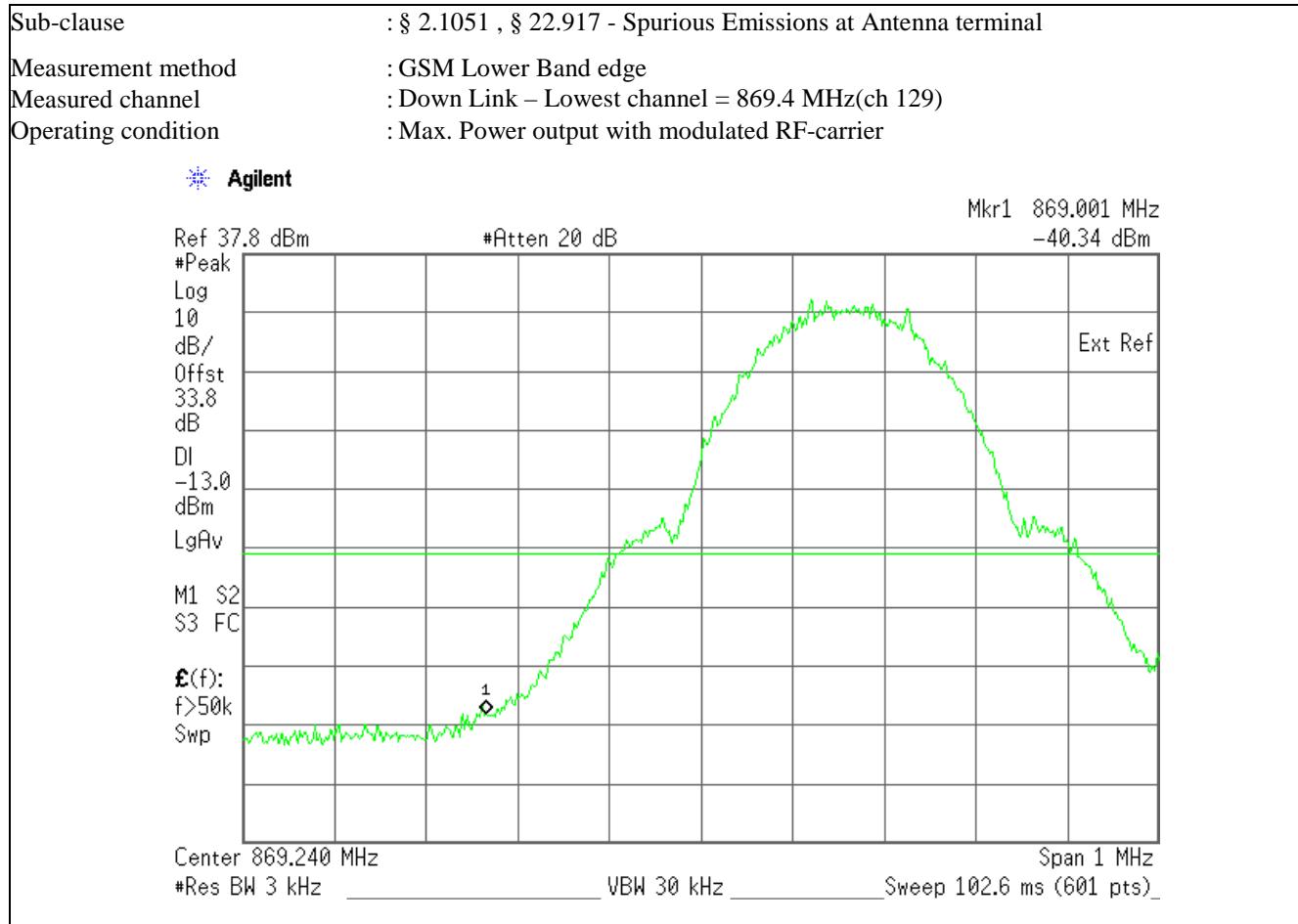
Measurement method : Input Intermodulation

Measured channel : WCDMA Down Link – Lower N & N-2 order channel input(N = 4FA & 2FA)

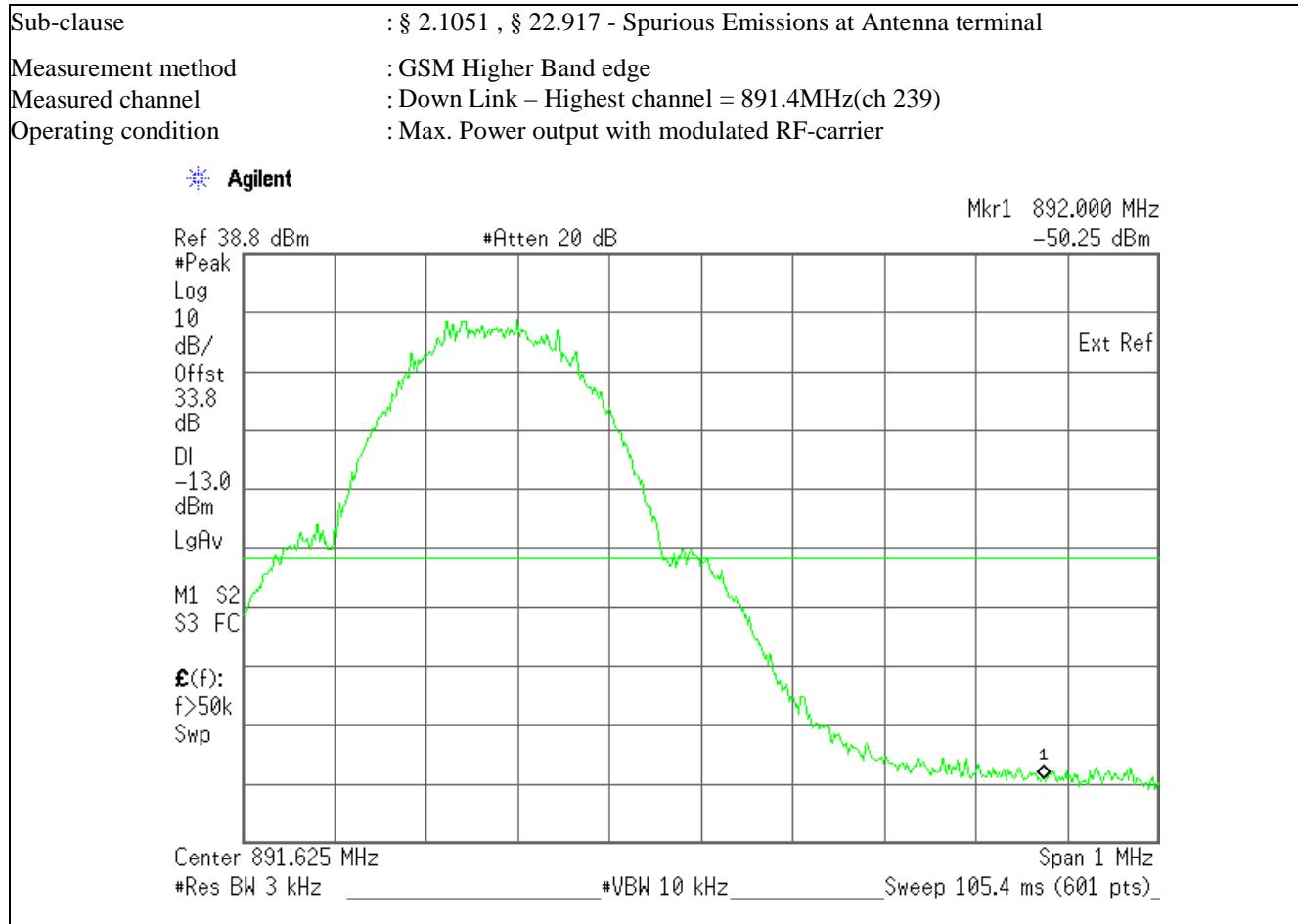
Operating condition : Max. Power output with modulated RF-carrier



A1. Measurement result – Plot no. 32



A1. Measurement result – Plot no. 33



A1. Measurement result – Plot no. 34

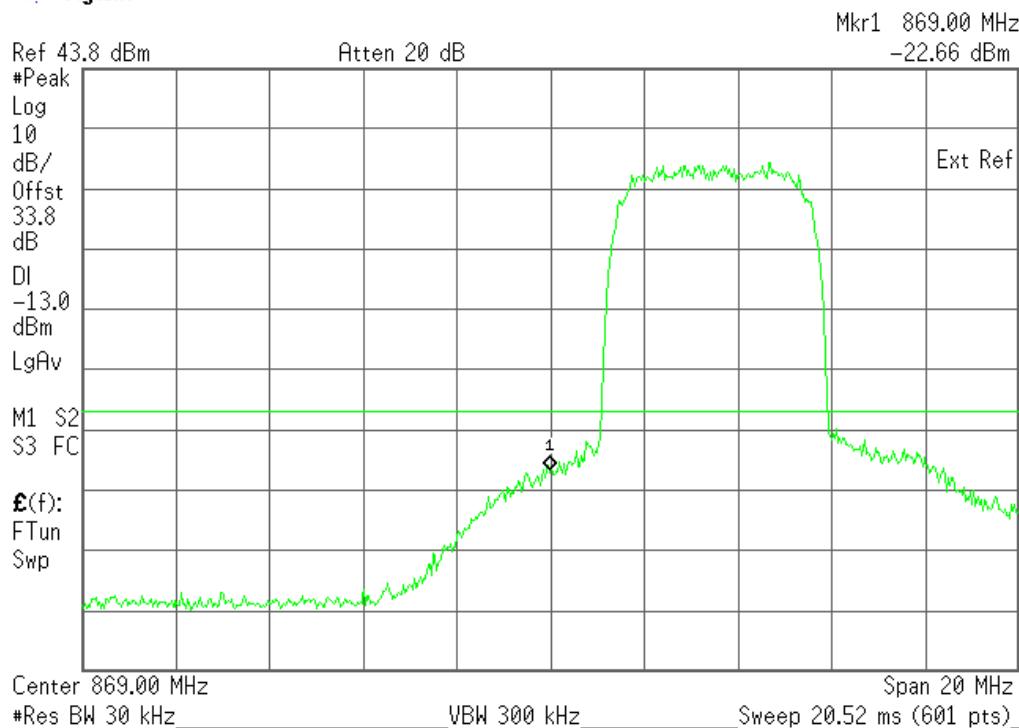
Sub-clause : § 2.1051 , § 22.917 - Spurious Emissions at Antenna terminal

Measurement method : WCDMA Lower Band edge

Measured channel : Down Link – Lowest FA = 872.5 MHz

Operating condition : Max. Power output with modulated RF-carrier

 Agilent



A1. Measurement result – Plot no. 35

Sub-clause : § 2.1051 , § 22.917 - Spurious Emissions at Antenna terminal

Measurement method : WCDMA Lower Band edge

Measured channel : Down Link – Highest FA = 887.5 MHz

Operating condition : Max. Power output with modulated RF-carrier

 Agilent

