

FCC PART 22/24 TEST REPORT**FCC Part 22 /Part 24****Report Reference No.....** : MWR150600501**FCC ID.....** : 2AFAP0AX1

Compiled by

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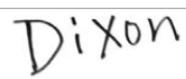
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Date of issue..... : July 07, 2015

Representative Laboratory Name : Maxwell International Co., Ltd.

Address..... : Room 509, Hongfacenter building, Baoan District, Shenzhen, Guangdong, China

Testing Laboratory Name : Shenzhen CTL Testing Technology Co., Ltd.

Address..... : Floor 1-A, Baisha Technology Park, No. 3011, Shahexi Road, Nanshan, Shenzhen, China

Applicant's name : ALPHA EXPORT AND IMPORT CO.,LIMITED

Address..... : Room 4d, Huashang Block, NO.3, Biezhan Road, Shenzhen , China

Test specification :

Standard : FCC Part 22: PUBLIC MOBILE SERVICES

FCC Part 24: PERSONAL COMMUNICATIONS SERVICES

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Test item description : Mobile Phone

Trade Mark : ALPHARD

Manufacturer : ALPHA EXPORT AND IMPORT CO.,LIMITED

Model/Type reference..... : AX1

Listed Models : AX2, AX3, AX4, AX5, AX6, AX7, AX8, AX9, AX10

Ratings..... : DC 3.70V

Modulation : GMSK, 8PSK

GPRS..... : Supported

EGPRS : Supported

Hardware version : S9-V2.3

Software version : S9_72KK_KK_3G_EMMC_32_4_XX_ZXMD_20150604-114737

Frequency..... : GSM 850MHz; PCS 1900MHz;

Result..... : **PASS**

TEST REPORT

Test Report No. :	MWR150600501	July 07, 2015 Date of issue
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Equipment under Test : Mobile Phone

Model /Type : AX1

Listed Models : AX2, AX3, AX4, AX5, AX6, AX7, AX8, AX9, AX10

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Test Result:	PASS
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The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

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1. TEST STANDARDS

The tests were performed according to following standards:

[FCC Part 22 \(10-1-12 Edition\)](#): PRIVATE LAND MOBILE RADIO SERVICES.

[FCC Part 24\(10-1-12 Edition\)](#): PUBLIC MOBILE SERVICES

[TIA/EIA 603 D June 2010](#): Land Mobile FM or PM Communications Equipment Measurement and Performance Standards.

[FCC Part 2](#): FREQUENCY ALLOCA-TIONS AND RADIO TREATY MAT-TERS; GENERAL RULES AND REG-ULATIONS

[ANSI C63.4:2009](#): Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

[KDB 971168 D01 Power Meas License Digital Systems v02r02](#): MEASUREMENT GUIDANCE FOR CERTIFICATION OF LICENSED DIGITAL TRANSMITTERS

2. SUMMARY

2.1. General Remarks

Date of receipt of test sample	:	Jun 18, 2015
Testing commenced on	:	Jun 20,2015
Testing concluded on	:	July 07 ,2015

2.2. Product Description

The **ALPHA EXPORT AND IMPORT CO., LIMITED**'s Model: AX1 or the "EUT" as referred to in this report; more general information as follows, for more details, refer to the user's manual of the EUT.

Name of EUT	Mobile Phone
Model Number	AX1
Serial Number	AX8745B485
Modulation Type	GMSK for GSM/GPRS, 8-PSK for EDGE QPSK for UMTS
Antenna Type	Internal
UMTS Operation Frequency Band	Device supported UMTS Band I/UMTS Band V
	IEEE 802.11b:2412-2462MHz
WLAN FCC Operation frequency	IEEE 802.11g:2412-2462MHz IEEE 802.11n HT20:2412-2462MHz IEEE 802.11n HT40:2422-2452MHz
BT FCC Operation frequency	2402MHz-2480MHz
HSDPA Release Version:	Release 7, CAT14
HSUPA Release Version:	Release 6, CAT6
DC-HSUPA Release Version	Not Supported
WCDMA Release Version	R99
	IEEE 802.11b: DSSS(CCK,DQPSK,DBPSK)
WLAN FCC Modulation Type	IEEE 802.11g: OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n HT20: OFDM (64QAM, 16QAM, QPSK,BPSK) IEEE 802.11n HT40: OFDM (64QAM, 16QAM, QPSK,BPSK)
BT Modulation Type	GFSK (BT 4.0)/GFSK,8DPSK,π/4DQPSK(BT 3.0+EDR)
Hardware version	S9_V2.3
Software version	S9_72KK_KK_3G_EMMC_32_4_XX_ZXMD_20150604-114737
GPS function	Supported
WLAN	Supported 802.11b/802.11g/802.11n
Bluetooth	Supported BT 4.0/BT 3.0+EDR
GSM/EDGE/GPRS	Supported GSM/GPRS/EDGE
GSM/EDGE/GPRS Power Class	GSM850:Power Class 4/PCS1900:Power Class 1
GSM/EDGE/GPRS Operation Frequency	GSM850 :824.2MHz-848.8MHz PCS1900:1850.2MHz-1909.8MHz
GSM/EDGE/GPRS Operation Frequency Band	GSM850/PCS1900/GPRS850/ GPRS1900/EDGE850/EDGE1900
GSM Release Version	R99
GPRS/EDGE Multislot Class	GPRS/EDGE: Multi-slot Class 12
Extreme temp. Tolerance	-30°C to +50°C
Extreme vol. Limits	3.00VDC to 4.35VDC (nominal: 3.70VDC)
GPRS operation mode	Class B

2.3. Equipment under Test

Power supply system utilised

Power supply voltage	:	<input type="radio"/>	120V / 60 Hz	<input type="radio"/>	115V / 60Hz
		<input type="radio"/>	12 V DC	<input type="radio"/>	24 V DC
		<input checked="" type="radio"/>	Other (specified in blank below)		

DC 3.70V

Test frequency list

Test Mode	TX/RX	RF Channel		
		Low(L)	Middle (M)	High (H)
GSM850	TX	Channel 128	Channel 190	Channel 251
		824.2 MHz	836.6 MHz	848.8 MHz
	RX	Channel 128	Channel 190	Channel 251
		869.2 MHz	881.6 MHz	893.8 MHz
Test Mode	TX/RX	RF Channel		
		Low(L)	Middle (M)	High (H)
GSM1900	TX	Channel 512	Channel 661	Channel 810
		1850.2 MHz	1880.0 MHz	1909.8 MHz
	RX	Channel 512	Channel 661	Channel 810
		1930.2 MHz	1960.0 MHz	1989.8 MHz
Test Mode	TX/RX	RF Channel		
		Low(L)	Middle (M)	High (H)
UMTS Band V	TX	Channel 4132	Channel 4182	Channel 4233
		826.4 MHz	836.4 MHz	846.6 MHz
	RX	Channel 4357	Channel 4407	Channel 4458
		871.4 MHz	881.4 MHz	891.6 MHz

2.4. Short description of the Equipment under Test (EUT)

2.4.1 General Description

AX1 is subscriber equipment in the UMTS/GSM system. Support HSPA/UMTS frequency band I and band V, only UMTS band V used in USA; The GSM/GPRS/EDGE frequency band includes GSM850 and GSM900 and DCS1800 and PCS1900. The Mobile Phone implements such functions as RF signal receiving/transmitting, HSPA/UMTS and GSM/GPRS/EDGE protocol processing, voice, video MMS service, GPS and WIFI etc. Externally it provides micro SD card interface, earphone port (to provide voice service) and SIM card interface. It also provides Bluetooth module to synchronize data between a PC and the phone, or to use the built-in modem of the phone to access the Internet with a PC, or to exchange data with other Bluetooth devices.

NOTE: Unless otherwise noted in the report, the functional boards installed in the units shall be selected from the below list, but not means all the functional boards listed below shall be installed in one unit.

2.4.2 Technical Specification

Characteristics	Description	
Radio System Type	<input checked="" type="checkbox"/> GSM/ <input type="checkbox"/> UMTS	
Supported Frequency Range	GSM850/UMTS Band V	Transmission(TX): 824 to 849MHz Receiving(RX): 869 to 894MHz
	GSM1900	Transmission(TX): 1850 to 1910MHz Receiving(RX): 1930 to 1990MHz
TX and RX Antenna Ports	TX& RX port:	1
Supported Channel Bandwidth Designation of Emissions (Note: the necessary bandwidth of which is the worst value from the measured occupied bandwidths for each type of channel bandwidth configuration.)	GSM system:	200 kHz
	UMTS system:	5 MHz
	GSM850:	245KGXW
	EGPRS 850	248KG7W
	GSM1900:	247KGXW
	EGPRS 1900	245KG7W
	UMTS 850:	4M18F9W

2.5. Internal Identification of AE used during the test

AE ID*	Description
AE1	Charger

AE1
 Model: ETA-U90JWE
 INPUT:100-240V 50/60Hz 0.35A
 OUTPUT: DC 5.0V,2 A

*AE ID: is used to identify the test sample in the lab internally.

2.6. Normal Accessory setting

Fully charged battery was used during the test.

2.7. EUT configuration

The following peripheral devices and interface cables were connected during the measurement:

- - supplied by the manufacturer
- - supplied by the lab

<input type="radio"/>	Power Cable	Length (m) :	/
		Shield :	/
		Detachable :	/
<input type="radio"/>	Multimeter	Manufacturer :	/
		Model No. :	/

2.8. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for **2AFAP0AX1** filing to comply with FCC Part 22 Rules

2.9. Modifications

No modifications were implemented to meet testing criteria.

2.10. General Test Conditions/Configurations

2.10.1 Test Modes

NOTE: The test mode(s) are selected according to relevant radio technology specifications.

Test Mode	Test Modes Description
GSM/TM1	GSM system, GSM,GMSK modulation
GSM/TM2	GSM system, GPRS, GMSK modulation
GSM/TM3	GSM system, EDGE, 8PSKmodulation

Note:

1. This EUT owns two SIM cards, after we perform the pretest for these two SIM cards; we found the SIM 1 is the worst case, so its result is recorded in this report.
2. GSM and GPRS with the same emission designator, test result recorded in this report at the worst case GSM/TM1 only.

2.10.2 Test Environment

Environment Parameter	Selected Values During Tests	
Relative Humidity	Ambient	
Temperature	TN	Ambient
Voltage	VL	3.00V
	VN	3.70V
	VH	4.35V

NOTE: VL=lower extreme test voltage VN=nominal voltage
 VH=upper extreme test voltage TN=normal temperature

2.11. Note

1. The EUT is a Mobile Phone with UMTS/GSM/GPRS/EDGE, WiFi and Bluetooth function, The functions of the EUT listed as below:

	Test Standards	Reference Report
GSM/GPRS/EDGE	FCC Part 22/FCC Part 24	MWR150600501
WCDMA	FCC Part 22	MWR150600502
Bluetooth	FCC Part 15 C 15.247	MWR150600503
BLE	FCC Part 15 C 15.247	MWR150600504
WiFi	FCC Part 15 C 15.247	MWR150600505
USB Port	FCC Part 15 B	MWR150600506
SAR	FCC Part 2 §2.1093	MWR150600507

3. TEST ENVIRONMENT

3.1. Address of the test laboratory

Shenzhen CTL Testing Technology Co., Ltd.

Floor 1-A, Baisha Technology Park, No. 3011, Shahexi Road, Nanshan, Shenzhen, China
The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 (2003) and CISPR Publication 22.

3.2. Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

FCC-Registration No.: 970318

Shenzhen CTL Testing Technology Co., Ltd. has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 970318, Dec 19, 2013

3.3. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	15-35 ° C
Humidity:	30-60 %
Atmospheric pressure:	950-1050mbar

3.4. Test Description

3.4.1 Cellular Band (824-849MHz paired with 869-894MHz)

Test Item	FCC Rule No.	Requirements	Verdict
RF Output Power	§2.1046, §22.913	FCC: ERP ≤ 7W.	Pass
Modulation Characteristics	§2.1047	Digital modulation	N/A
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.	Pass
Band Edges Compliance	§2.1051, §22.917	≤-13dBm/1%*EBW, in 1MHz bands immediately outside and adjacent to The frequency block.	Pass
Spurious Emission at Antenna Terminals	§2.1051, §22.917	FCC: ≤ -13dBm/100kHz, from 9kHz to 10th harmonics but outside authorized operating frequency ranges.	Pass
Field Strength of Spurious Radiation	§2.1053, §22.917	FCC: ≤ -13dBm/100kHz.	Pass
Frequency Stability	§2.1055, §22.355	≤ ±2.5ppm.	Pass

NOTE 1: For the verdict, the "N/A" denotes "not applicable", the "N/T" denotes "not tested".

3.4.2 PCS Band (1850-1915MHz paired with 1930-1995MHz)

Test Item	FCC Rule No.	Requirements	Verdict
RF Output Power	§2.1046, §24.232	EIRP ≤ 2W	Pass
Peak-Average Ratio	§2.1046, §24.232	FCC:Limit≤13dB	N/A ^[2]
Modulation Characteristics	§2.1047	Digital modulation	N/A
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.	Pass
Band Edges Compliance	§2.1051, §24.238	≤ -13dBm/1%*EBW, In 1MHz bands immediately outside and adjacent to The frequency block.	Pass
Spurious Emission at Antenna Terminals	§2.1051, §24.238	≤-13dBm/1MHz, from 9kHz to10th harmonics but outside authorized Operating frequency ranges.	Pass
Field Strength of Spurious Radiation	§2.1053, §24.238	≤ -13dBm/1MHz.	Pass
Frequency Stability	§2.1055, §24.235	FCC: within authorized frequency block.	Pass

NOTE 1: For the verdict, the "N/A" denotes "not applicable", the "N/T" de notes "not tested".

Remark:

1. The measurement uncertainty is not included in the test result.
2. The power was tested in peak values. PAPR not required according to KDB971168.

3.5. Equipments Used during the Test

Output Power(Conducted) & Occupied Bandwidth & Emission Bandwidth & Band Edge Compliance & Conducted Spurious Emission					
No.	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	Radio Communication Tester	R&S	CMU200	115419	2015/05/22
2	Spectrum Analyzer	R&S	FSU26	103710	2015/06/02
3	Splitter	Mini-Circuit	ZAPD-4	400059	2015/06/02
4	RF cable 1	MURATA	MXHS83QE3000	1420355	2015/05/21
5	RF cable 2	MURATA	MXHS83QE3000	1420356	2015/05/21

Frequency Stability					
No.	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	Radio Communication Tester	R&S	CMU200	115419	2015/05/22
2	Spectrum Analyzer	R&S	FSU26	103710	2015/06/02
3	Splitter	Mini-Circuit	ZAPD-4	400059	2015/06/02
4	RF cable 1	MURATA	MXHS83QE3000	1420355	2015/05/21
5	RF cable 2	MURATA	MXHS83QE3000	1420356	2015/05/21
6	Climate Chamber	ESPEC	EL-10KA	A20120523	2015/05/20

Output Power (Radiated) & Radiated Spurious Emission					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	Bilog Antenna	Sunol Sciences Corp.	JB1	A061713	2015/06/02
2	Bilog Antenna	Sunol Sciences Corp.	JB1	A061714	2015/06/02
3	EMI TEST Receivcer	Rohde&Schwarz	ESCI	103710	2015/06/02
4	EMI TEST Software	Audix	E3	N/A	N/A
5	EMI TEST Software	Rohde&Schwarz	ESK1	N/A	N/A
6	HORN ANTENNA	Sunol Sciences Corp.	DRH-118	A062013	2015/05/19
7	HORN ANTENNA	Sunol Sciences Corp.	DRH-118	A062014	2015/05/19
8	Amplifier	HP	8349B	3008A02306	2015/05/19
9	Preamplifier	HP	8447D	2944A10176	2015/05/19
10	Loop Antenna	Daze	ZN30900A	N/A	2015/05/19
11	Horn Antenna	ShwarzBeck	BBHA9170	25841	2015/05/19

12	Horn Antenna	ShwarzBeck	BBHA9170	25842	2015/05/19
13	Radio Communication Tester	R&S	CMU200	115419	2015/05/22
14	Splitter	Mini-Circuit	ZAPD-4	400059	2015/06/02
15	Coaxial Cables	HUBER+SUHNER	SUCOFLEX 104PEA-10M	10m	2015/05/21
16	Coaxial Cables	HUBER+SUHNER	SUCOFLEX 104PEA-3M	3m	2015/05/21
17	Spectrum Analyzer	Agilent	E4407B	MY41440676	2015/05/21
18	SIGNAL GENERATOR	Agilent	E4421B	US40051744	2015/05/20

The calibration interval was one year.

4. TEST CONDITIONS AND RESULTS

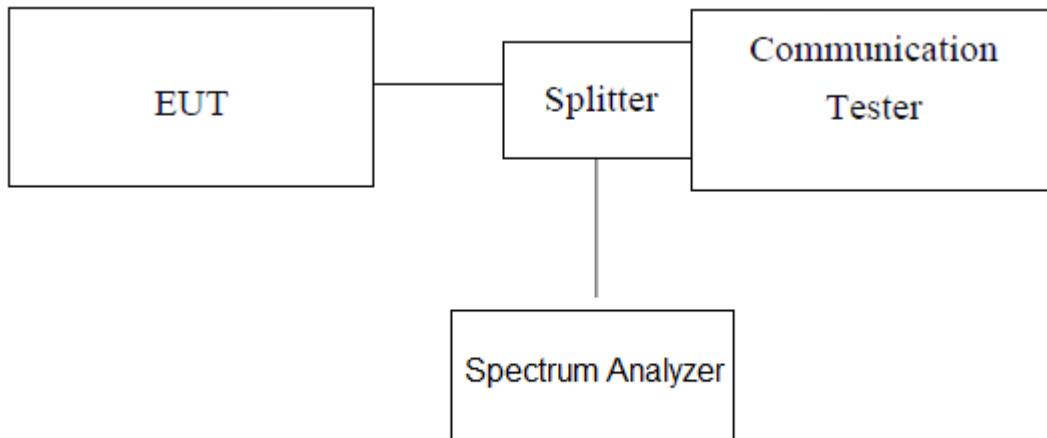
4.1. Output Power

TEST APPLICABLE

During the process of testing, the EUT was controlled via Agilent Digital Radio Communication tester (CMU200) to ensure max power transmission and proper modulation. This result contains output power and EIRP measurements for the EUT. In all cases, output power is within the specified limits.

4.1.1. Conducted Output Power

TEST CONFIGURATION



Note: Measurement setup for testing on Antenna connector

TEST PROCEDURE

1. The transmitter output port was connected to base station.
2. The RF output of EUT was connected to the power meter by RF cable and attenuator, the path loss was compensated to the results for each measurement.
3. Set EUT at maximum power through base station.
4. Select lowest, middle, and highest channels for each band and different modulation.
5. These measurements were done at 3 frequencies, 1850.20 MHz, 1880.00 MHz and 1909.80 MHz for PCS1900 band; 824.20 MHz, 836.60 MHz and 848.80 MHz for GSM850 band. (Low, middle and high of operational frequency range).
6. Set Spectrum Analyzer RBW=1MHz, VBW=3MHz, Dector: Peak; read peak values.

TEST RESULTS

GSM/TM1/GSM850(GMSK)		
Frequency (MHz)	Power Step	Output Power (dBm)
824.20	5	31.05
836.60	5	31.85
848.80	5	31.94

GSM/TM3/EGPRS850(8psk,1Slot)		
Frequency (MHz)	Power Step	Output Power (dBm)
824.20	E3	26.54
836.60	E3	26.78
848.80	E3	26.87

GSM/TM1/PCS1900(GMSK)		
Frequency (MHz)	Power Step	Output Power (dBm)
1850.20	0	29.15
1880.00	0	29.26
1909.80	0	29.65

GSM/TM3/EGPRS1900(8psk,1Slot)		
Frequency (MHz)	Power Step	Output Power (dBm)
1850.20	E3	26.33
1880.00	E3	26.57
1909.80	E3	26.85

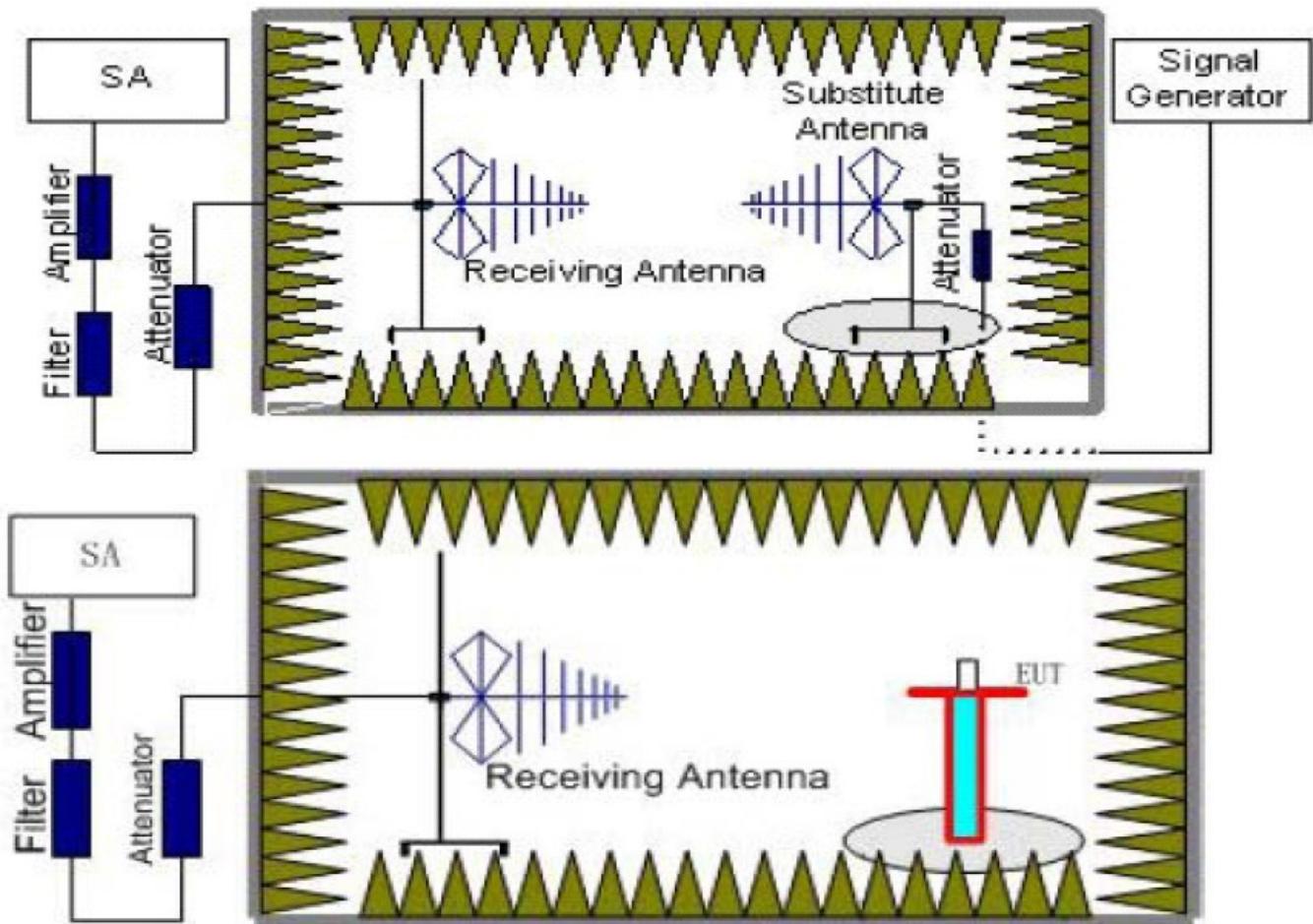
4.1.2. Radiated Output Power

TEST DESCRIPTION

This is the test for the maximum radiated power from the EUT.

Rule Part 24.232(c) specifies, "Mobile/portable stations are limited to 2 watts e.i.r.p. Peak power" and 24.232(e) specifies that "Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage." Rule Part 22.913(a) specifies "The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts."

TEST CONFIGURATION



TEST PROCEDURE

1. EUT was placed on a 0.8m meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The height of receiving antenna is 0.8m. Detected emissions were maximized at each frequency by rotating the EUT through 360° and adjusting the receiving antenna polarization. The radiated emission measurements of all transmit frequencies in three channels (High, Middle, Low) were measured with peak detector.
2. A log-periodic antenna or double-ridged waveguide horn antenna shall be substituted in place of the EUT. The log-periodic antenna will be driven by a signal generator and the level will be adjusted till the same power value on the spectrum analyzer or receiver. The level of the spurious emissions can be calculated through the level of the signal generator, cable loss, the gain of the substitution antenna and the reading of the spectrum analyzer or receiver.
3. The EUT is then put into continuously transmitting mode at its maximum power level during the test. Set Test Receiver or Spectrum RBW=1MHz, VBW=3MHz, And the maximum value of the receiver should be recorded as (P_r).
4. The EUT shall be replaced by a substitution antenna. In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power (P_{Mea}) is applied to the input of the substitution antenna, and adjust the level of the signal generator output until the value of the receiver

reach the previously recorded (P_r). The power of signal source (P_{Mea}) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.

5. A amplifier should be connected to the Signal Source output port. And the cable should be connect between the Amplifier and the Substitution Antenna. The cable loss (P_{cl}), the Substitution Antenna Gain (G_a) and the Amplifier Gain (P_{Ag}) should be recorded after test.

The measurement results are obtained as described below:

$$\text{Power(EIRP)} = P_{Mea} - P_{Ag} - P_{cl} + G_a$$

We used SMF100A microwave signal generator which signal level can up to 33dBm, so we not used power Amplifier for substitution test; The measurement results are amend as described below:

$$\text{Power(EIRP)} = P_{Mea} - P_{cl} + G_a$$

6. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power.
7. ERP can be calculated from EIRP by subtracting the gain of the dipole, $ERP = EIRP - 2.15\text{dBi}$.

TEST RESULTS

Note: We test the H direction and V direction and V direction is worse.

GSM/TM1/GSM850									
Frequency (MHz)	P_{Mea} (dBm)	P_{cl} (dB)	G_a Antenna Gain(dB)	Correction (dB)	P_{Ag} (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)	Polarization
824.20	-11.96	2.42	8.45	2.15	36.82	28.74	38.45	9.71	V
836.60	-11.44	2.46	8.45	2.15	36.82	29.22	38.45	9.23	V
848.80	-12.14	2.53	8.36	2.15	36.82	28.36	38.45	10.09	V

GSM/TM3/EGPRS850									
Frequency (MHz)	P_{Mea} (dBm)	P_{cl} (dB)	G_a Antenna Gain(dB)	Correction (dB)	P_{Ag} (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)	Polarization
824.20	-16.16	2.42	8.45	2.15	36.82	24.54	38.45	13.91	V
836.60	-15.92	2.46	8.45	2.15	36.82	24.74	38.45	13.71	V
848.80	-16.17	2.53	8.36	2.15	36.82	24.33	38.45	14.12	V

GSM/TM1/PCS1900									
Frequency (MHz)	P_{Mea} (dBm)	P_{cl} (dB)	G_a Antenna Gain(dB)	P_{Ag} (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization	
1850.20	-12.91	3.41	10.24	33.6	27.52	33.01	5.49	H	
1880.00	-11.51	3.49	10.24	33.6	28.84	33.01	4.17	H	
1909.80	-12.14	3.55	10.23	33.6	28.14	33.01	4.87	H	

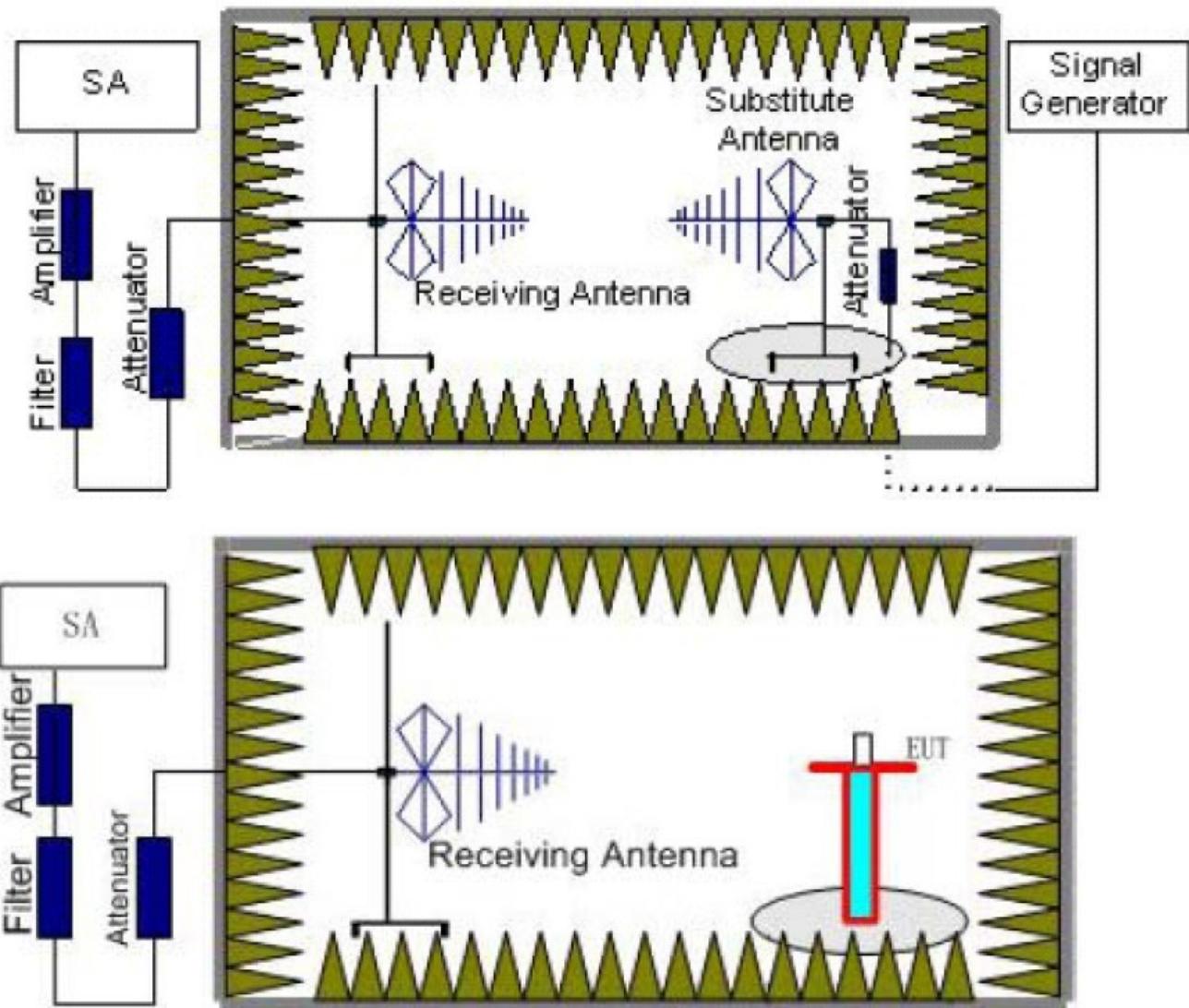
GSM/TM3/EGPRS1900									
Frequency (MHz)	P_{Mea} (dBm)	P_{cl} (dB)	G_a Antenna Gain(dB)	P_{Ag} (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization	
1850.20	-16.86	3.41	10.24	33.6	23.57	33.01	5.49	H	
1880.00	-16.73	3.49	10.24	33.6	23.62	33.01	4.17	H	
1909.80	-16.74	3.55	10.23	33.6	23.54	33.01	4.87	H	

4.2. Radiated Spurious Emission

TEST APPLICABLE

According to the TIA/EIA 603D:2010 test method, The Receiver or Spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier that can be as high as 1910 MHz. The resolution bandwidth is set as outlined in Part 24.238 and Part 22.917. The spectrum is scanned with the mobile station transmitting at carrier frequencies that pertain to low, mid and high channels of PCS1900 and GSM850.

TEST CONFIGURATION



TEST PROCEDURE

1. EUT was placed on a 0.8m high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The height of receiving antenna is 0.8m. Detected emissions were maximized at each frequency by rotating the EUT through 360° and adjusting the receiving antenna polarization. The radiated emission measurements of all transmit frequencies in three channels (High, Middle, Low) were measured with peak detector.
2. A log-periodic antenna or double-ridged waveguide horn antenna shall be substituted in place of the EUT. The log-periodic antenna will be driven by a signal generator and the level will be adjusted till the same power value on the spectrum analyzer or receiver. The level of the spurious emissions can be calculated through the level of the signal generator, cable loss, the gain of the substitution antenna and the reading of the spectrum analyzer or receiver.

3. The EUT is then put into continuously transmitting mode at its maximum power level during the test. Set Test Receiver or Spectrum RBW=1MHz,VBW=3MHz, And the maximum value of the receiver should be recorded as (P_r).
4. The EUT shall be replaced by a substitution antenna. In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power (P_{Mea}) is applied to the input of the substitution antenna, and adjust the level of the signal generator output until the value of the receiver reach the previously recorded (P_r). The power of signal source (P_{Mea}) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.
5. A amplifier should be connected to the Signal Source output port. And the cable should be connect between the Amplifier and the Substitution Antenna. The cable loss (P_{cl}), the Substitution Antenna Gain (G_a) and the Amplifier Gain (P_{Ag}) should be recorded after test.
The measurement results are obtained as described below:
$$\text{Power(EIRP)} = P_{Mea} - P_{cl} + G_a$$
6. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power.
7. ERP can be calculated from EIRP by subtracting the gain of the dipole, $\text{ERP} = \text{EIRP} - 2.15\text{dBi}$.
8. In order to make sure test results more clearly, we set frequency range and sweep time for difference frequency range as follows table:

Working Frequency	Subrange (GHz)	RBW	VBW	Sweep time (s)
TM1/GSM 850	0.00009~0.15	1KHz	3KHz	30
	0.00015~0.03	10KHz	30KHz	10
	0.03~1	100KHz	300KHz	10
	1~2	1 MHz	3 MHz	2
	2~5	1 MHz	3 MHz	3
	5~8	1 MHz	3 MHz	3
	8~10	1 MHz	3 MHz	3
	0.00009~0.15	1KHz	3KHz	30
TM1/GSM 1900	0.00015~0.03	10KHz	30KHz	10
	0.03~1	100KHz	300KHz	10
	1~2	1 MHz	3 MHz	2
	2~5	1 MHz	3 MHz	3
	5~8	1 MHz	3 MHz	3
	8~11	1 MHz	3 MHz	3
	11~14	1 MHz	3 MHz	3
	14~18	1 MHz	3 MHz	3
	18~20	1 MHz	3 MHz	2

TEST LIMITS

According to 24.238 and 22.917 specify that 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.

The specification that emissions shall be attenuated below the transmitter power (P) by at least $43 + 10 \log(P)$ dB, translates in the relevant power range (1 to 0.001 W) to -13 dBm. At 1 W the specified minimum attenuation becomes 43 dB and relative to a 30 dBm (1 W) carrier becomes a limit of -13 dBm. At 0.001 W (0 dBm) the minimum attenuation is 13 dB, which again yields a limit of -13 dBm. In this way a translation of the specification from relative to absolute terms is carried out.

Frequency	Channel	Frequency Range	Verdict
TM1/GSM 850	Low	9KHz-10GHz	PASS
	Middle	9KHz -10GHz	PASS
	High	9KHz -10GHz	PASS
TM1/GSM 1900	Low	9KHz -20GHz	PASS
	Middle	9KHz -20GHz	PASS
	High	9KHz -20GHz	PASS

GSM/TM1/GSM850						
Channel Number: 128				Test Frequency: 824.20 MHz		
Frequency (MHz)	P _{Mea} (dBm)	Path Loss	Antenna Gain	Peak ERIP (dBm)	Limit (dBm)	Polarization
1648.40	-37.54	4.32	6.77	-35.09	-13.00	H
2472.60	---			---	-13.00	H
1648.40	-31.88	4.32	6.77	-29.43	-13.00	V
2472.60	---			---	-13.00	V

GSM/TM1/GSM850						
Channel Number: 190				Test Frequency: 836.60 MHz		
Frequency (MHz)	P _{Mea} (dBm)	Path Loss	Antenna Gain	Peak ERIP (dBm)	Limit (dBm)	Polarization
1673.20	-35.22	4.55	6.77	-33	-13.00	H
2509.80	---			---	-13.00	H
1673.20	-29.36	4.55	6.77	-27.14	-13.00	V
2509.80	---			---	-13.00	V

GSM/TM1/GSM850						
Channel Number: 251				Test Frequency: 848.80 MHz		
Frequency (MHz)	P _{Mea} (dBm)	Path Loss	Antenna Gain	Peak ERIP (dBm)	Limit (dBm)	Polarization
1697.60	-36.47	4.29	6.83	-33.93	-13.00	H
2546.40	---			---	-13.00	H
1697.60	-32.21	4.29	6.83	-29.67	-13.00	V
2546.40	---			---	-13.00	V

GSM/TM1/PCS1900						
Channel Number: 512				Test Frequency: 1850.20 MHz		
Frequency (MHz)	P _{Mea} (dBm)	Path Loss	Antenna Gain	Peak ERIP(dBm)	Limit (dBm)	Polarization
3700.40	-38.54	4.55	12.34	-30.75	-13.00	H
5550.60	---			---	-13.00	H
3700.40	-40.21	4.55	12.34	-32.42	-13.00	V
5550.60	---			---	-13.00	V

GSM/TM1/PCS1900						
Channel Number: 661				Test Frequency: 1880.00 MHz		
Frequency (MHz)	P _{Mea} (dBm)	Path Loss	Antenna Gain	Peak ERIP(dBm)	Limit (dBm)	Polarization
3760.00	-37.52	4.55	12.40	-29.67	-13.00	H
5640.00	---			---	-13.00	H
3760.00	-39.63	4.55	12.40	-31.78	-13.00	V
5640.00	---			---	-13.00	V

GSM/TM1/PCS1900						
Channel Number: 810				Test Frequency: 1909.80 MHz		
Frequency (MHz)	P _{Mea} (dBm)	Path Loss	Antenna Gain	Peak ERIP(dBm)	Limit (dBm)	Polarization
3819.60	-40.32	4.51	12.43	-32.40	-13.00	H
5729.40	---			---	-13.00	H
3819.60	-35.20	4.51	12.43	-27.28	-13.00	V
5729.40	---			---	-13.00	V

Note:

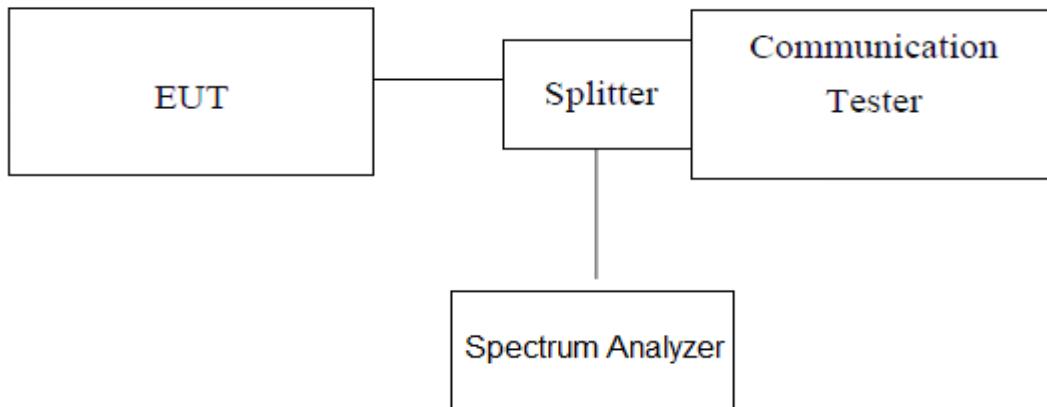
1. In general, the worse case attenuation requirement shown above was applied.
2. *** means that the emission level is too low to be measured or at least 20 dB down than the limit.

4.3. Occupied Bandwidth and Emission Bandwidth

TEST APPLICABLE

Similar to conducted emissions; occupied bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the extreme and mid frequencies of PCS1900 band and GSM850 band. The table below lists the measured 99% Bandwidth and -26dBc Bandwidth.

TEST CONFIGURATION



Note: Measurement setup for testing on Antenna connector

TEST PROCEDURE

1. The EUT was set up for the max output power with pseudo random data modulation;
2. Set RBW=10 KHz, VBW=30k KHz, Span=1MHz;
3. Set SPA Max hold and View, Set 99% Occupied Bandwidth/ Set -26dBc Occupied Bandwidth
4. These measurements were done at 3 frequencies, 1850.20 MHz, 1880.00 MHz and 1909.80 MHz for PCS1900 band; 824.20MHz, 836.60 MHz and 848.80 MHz for GSM850 band. (Low, middle and high of operational frequency range).

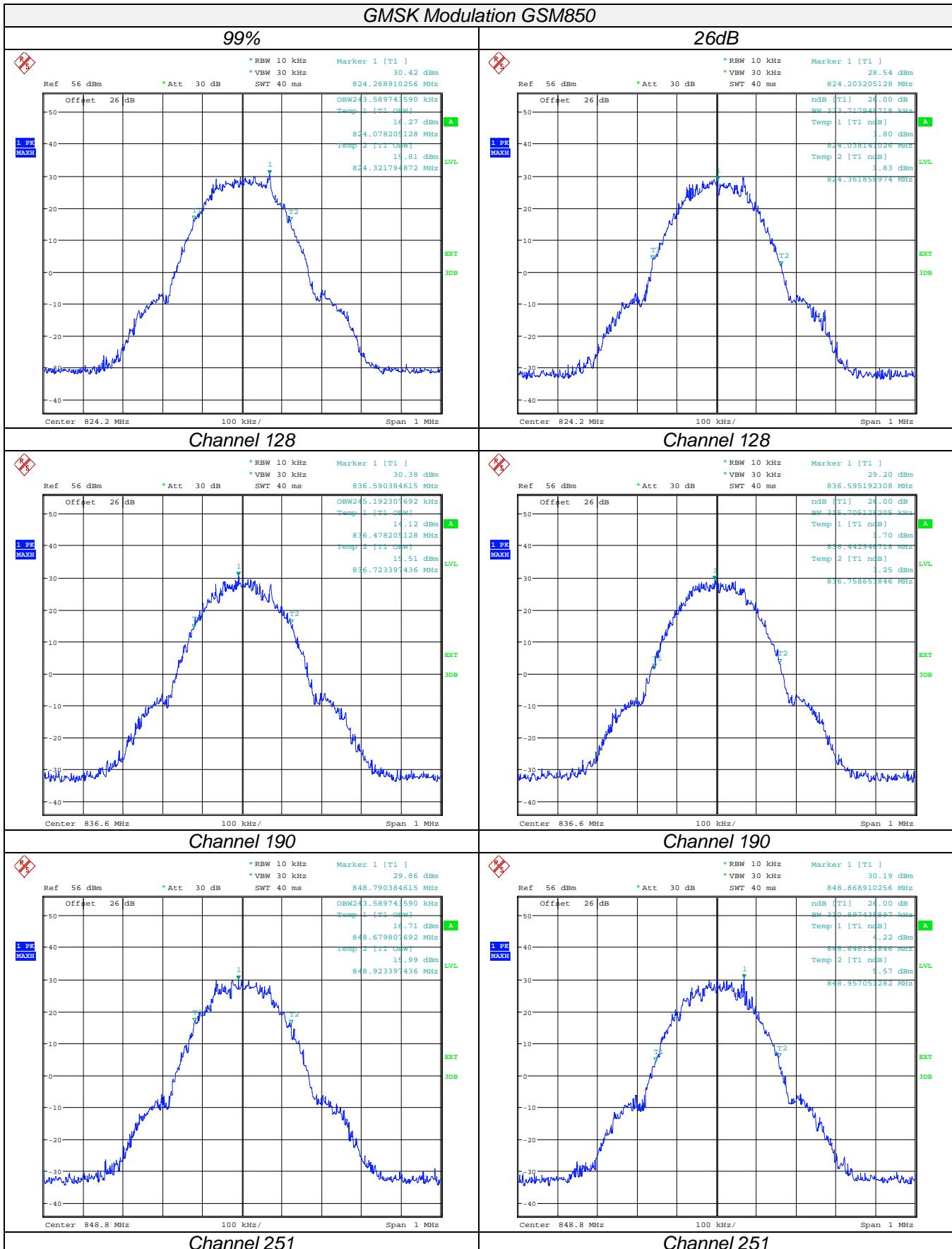
TEST RESULTS

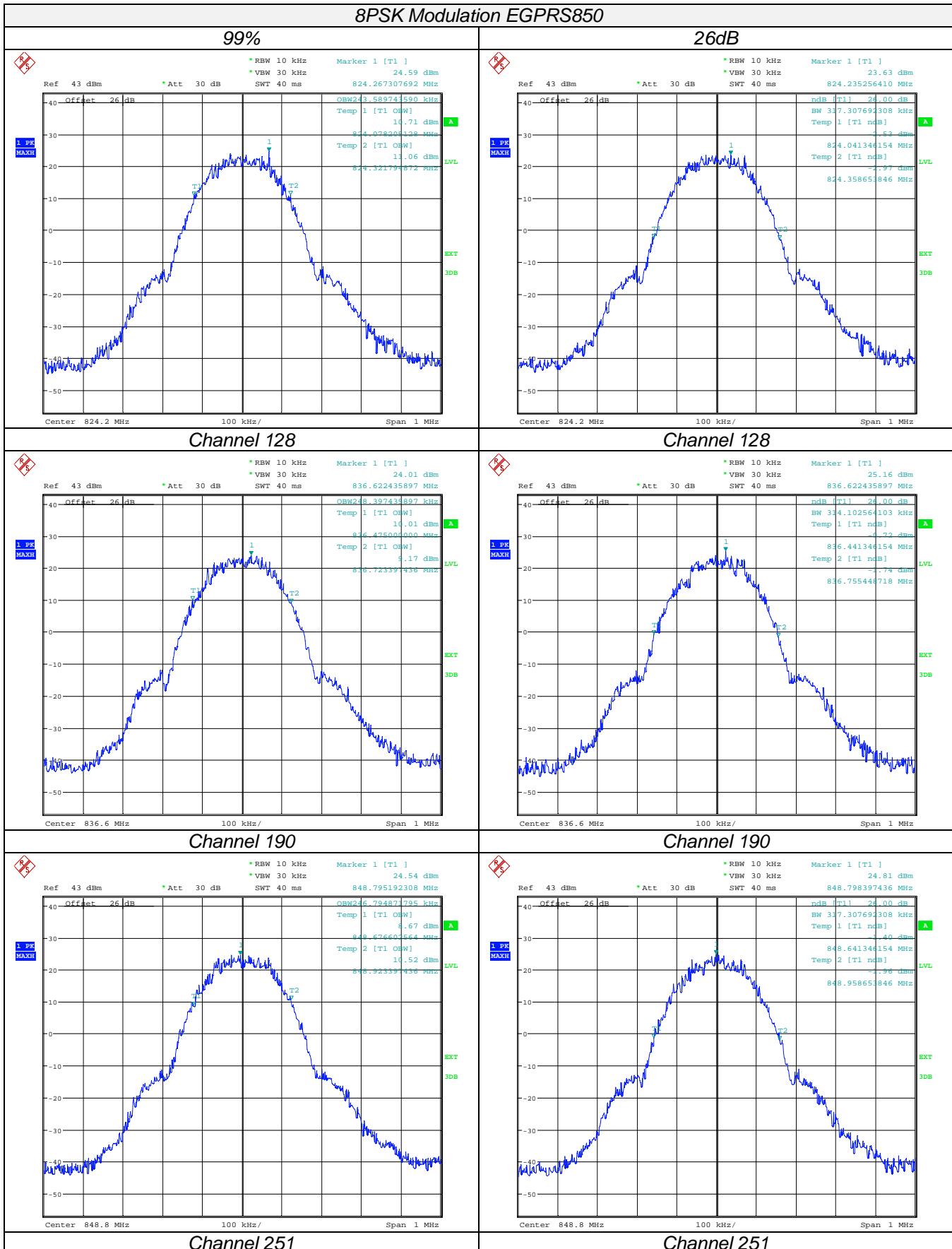
GSM/TM1/GSM850				
Channel Number	Frequency (MHz)	Occupied Bandwidth (99% BW) (kHz)	Emission Bandwidth (26 dBc BW) (kHz)	Verdict
128	824.20	243.59	323.72	PASS
190	836.60	245.19	315.71	PASS
251	848.80	243.59	310.90	PASS

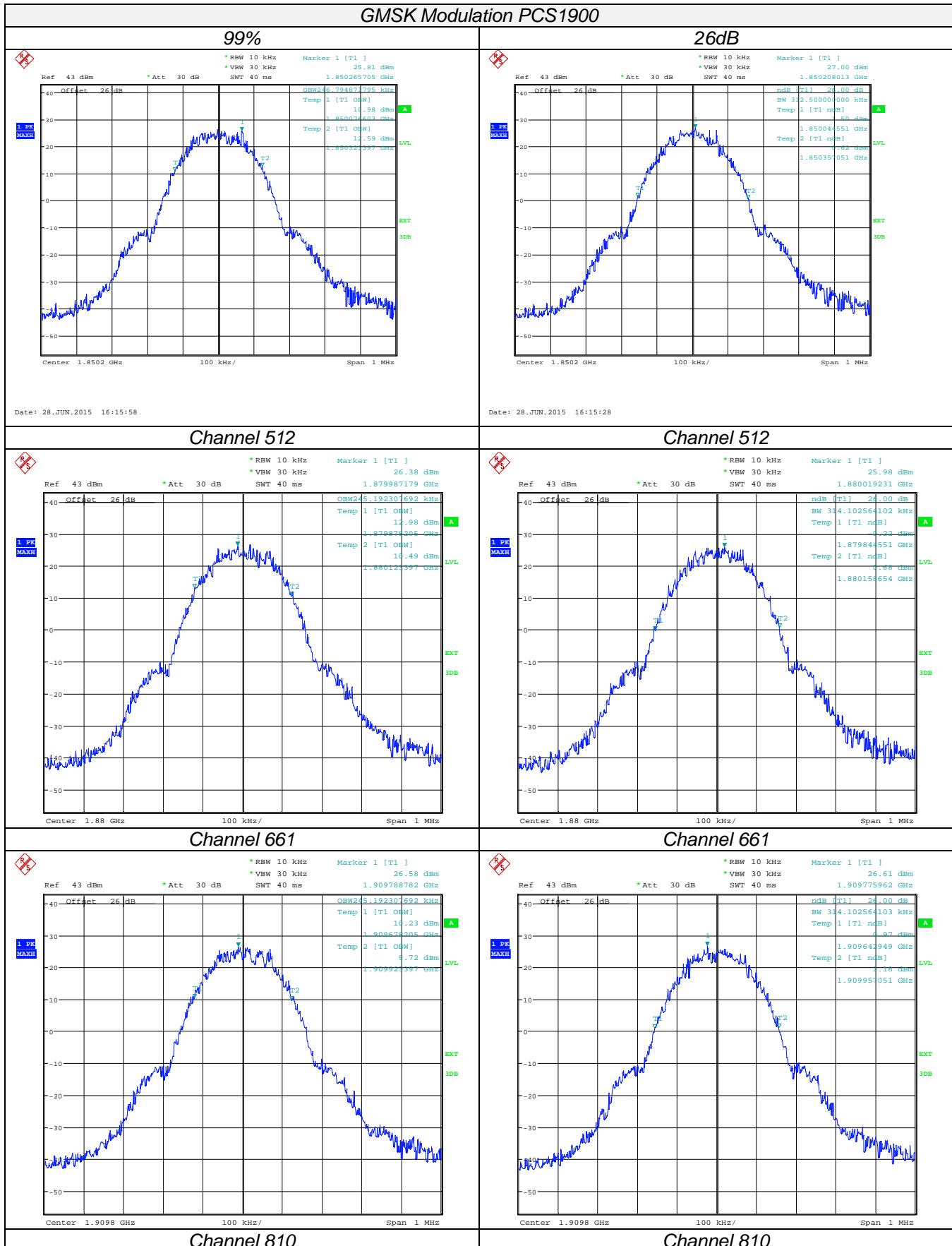
GSM/TM3/EGPRS850				
Channel Number	Frequency (MHz)	Occupied Bandwidth (99% BW) (kHz)	Emission Bandwidth (26 dBc BW) (kHz)	Verdict
128	824.20	243.59	317.31	PASS
190	836.60	248.40	314.10	PASS
251	848.80	246.79	317.31	PASS

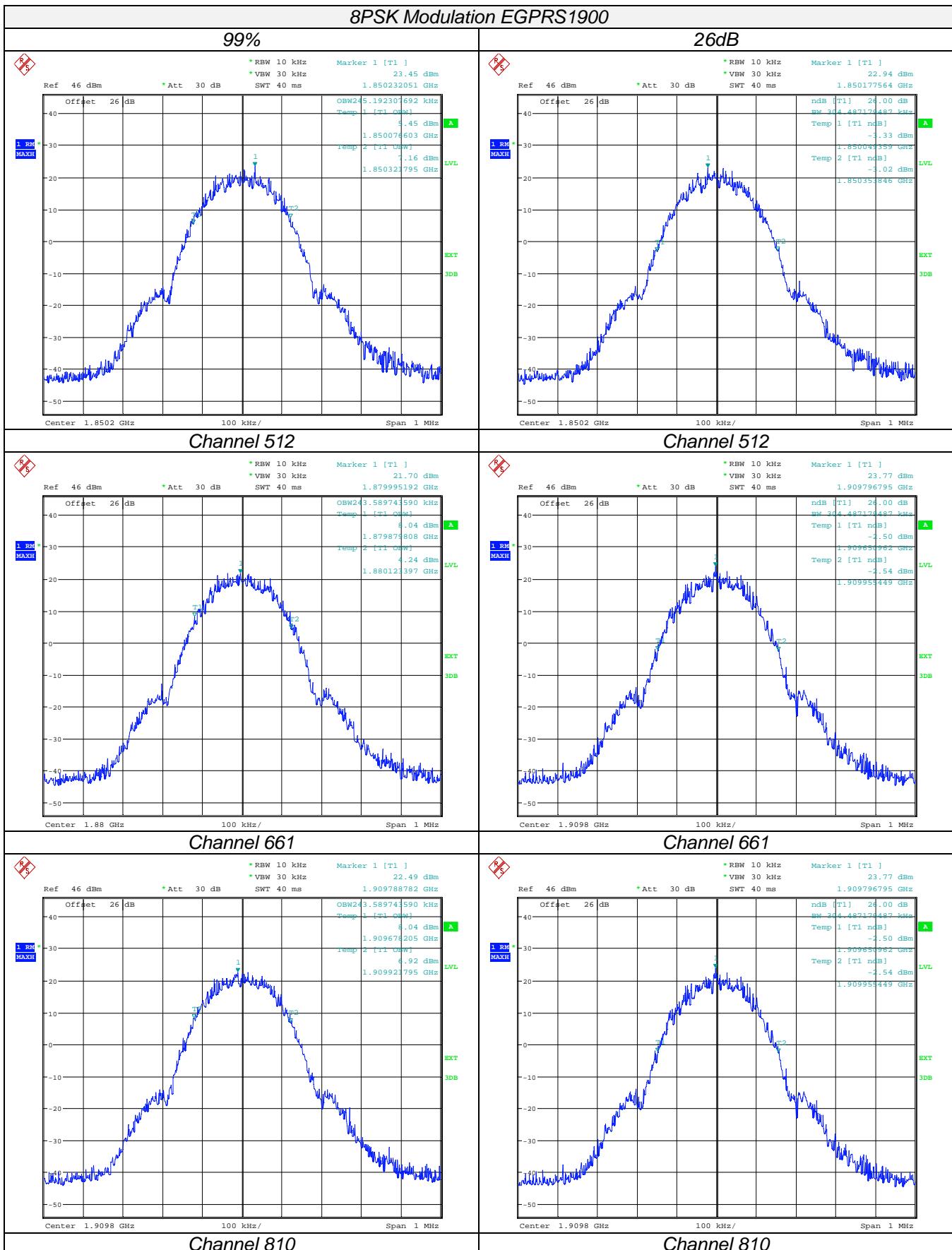
GSM/TM1/GSM1900				
Channel Number	Frequency (MHz)	Occupied Bandwidth (99% BW) (kHz)	Emission Bandwidth (26 dBc BW) (kHz)	Verdict
512	1850.20	246.79	312.50	PASS
661	1880.00	245.19	314.10	PASS
810	1909.80	245.19	314.10	PASS

GSM/TM3/EGPRS1900				
Channel Number	Frequency (MHz)	Occupied Bandwidth (99% BW) (kHz)	Emission Bandwidth (26 dBc BW) (kHz)	Verdict
512	1850.20	245.19	304.49	PASS
661	1880.00	243.59	304.49	PASS
810	1909.80	243.59	304.49	PASS







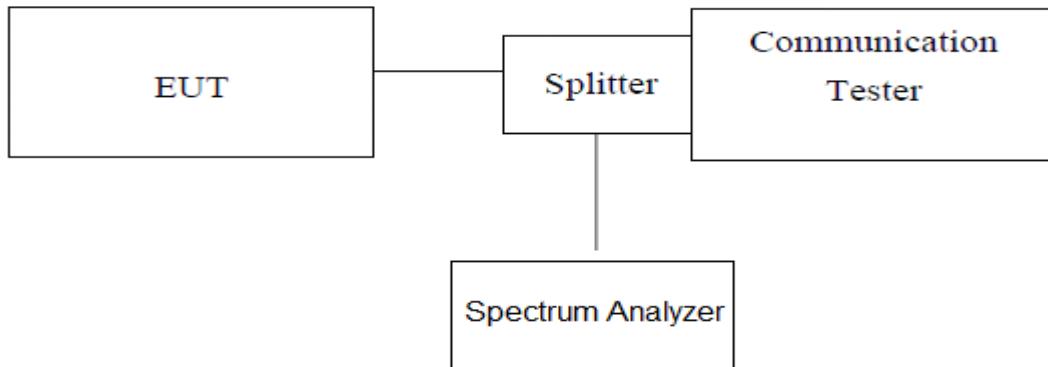


4.4. Band Edge Compliance

TEST APPLICABLE

During the process of testing, the EUT was controlled via Agilent Digital Radio Communication tester (CMU200) to ensure max power transmission and proper modulation.

TEST CONFIGURATION

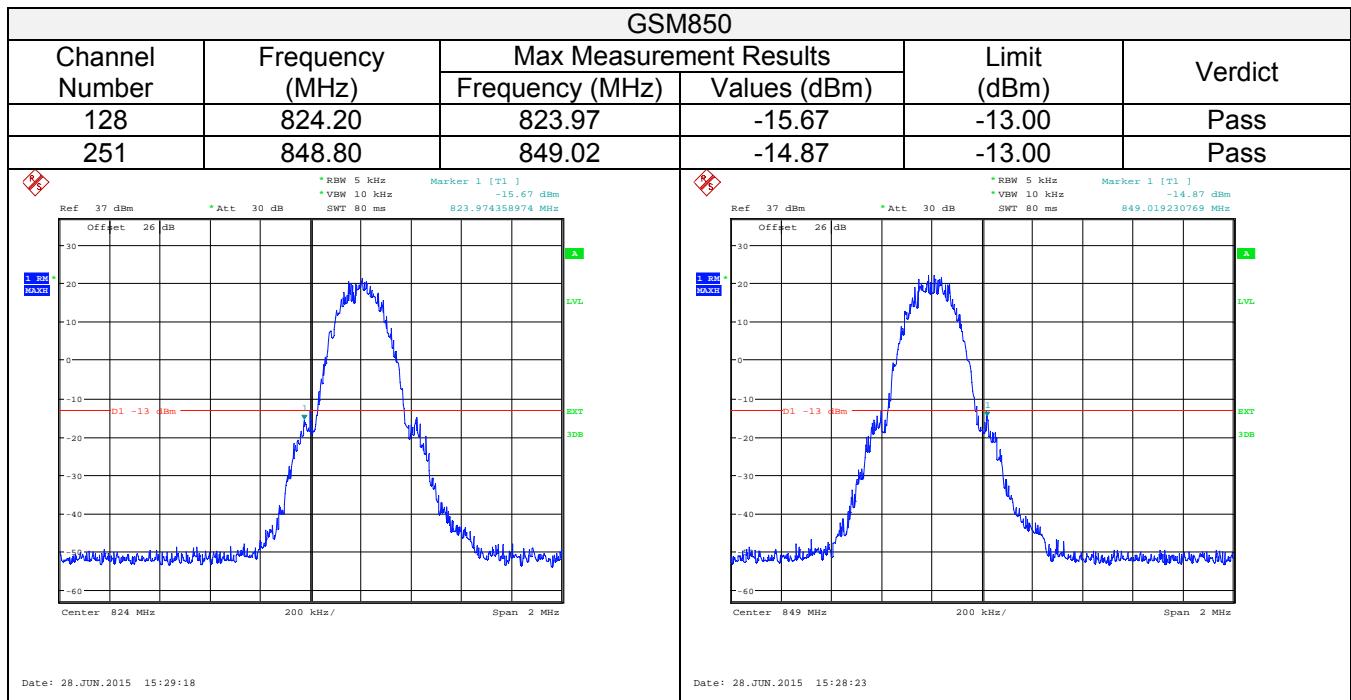


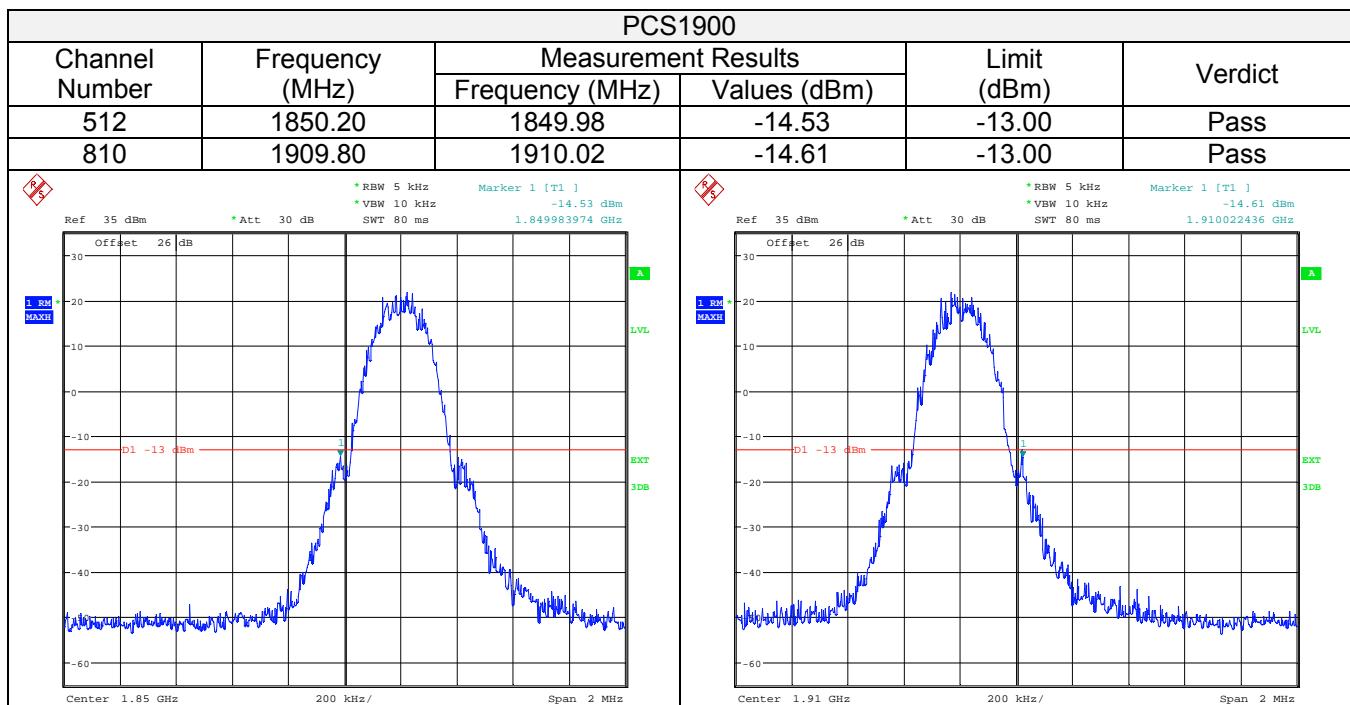
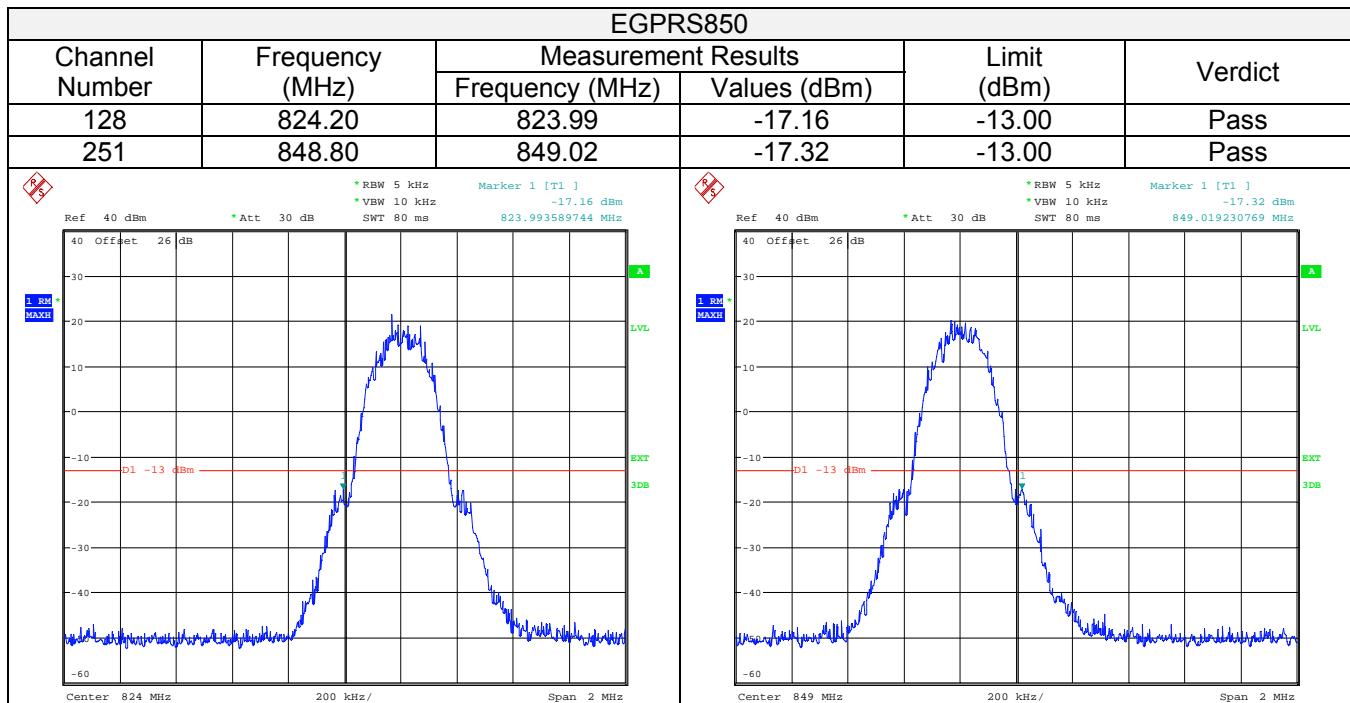
Note: Measurement setup for testing on Antenna connector

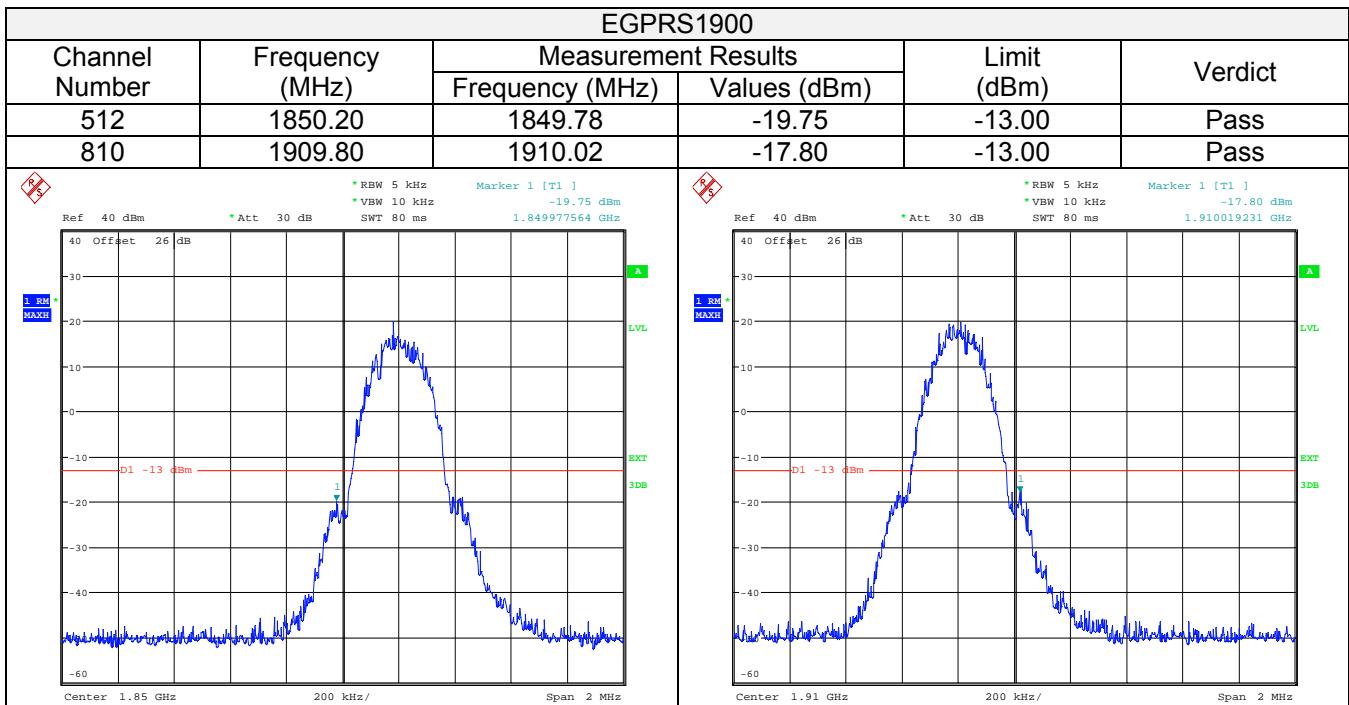
TEST PROCEDURE

1. The EUT was set up for the max output power with pseudo random data modulation;
2. Set RBW=5 KHz, VBW=50 KHz, Span=1MHz; Dector: Peak;
3. These measurements were done at 3 frequencies, 1850.20 MHz, 1880.00 MHz and 1909.80 MHz for PCS1900 band; 824.20 MHz, 836.60 MHz and 848.80 MHz for GSM850 band. (bottom, middle and top of operational frequency range).

TEST RESULTS







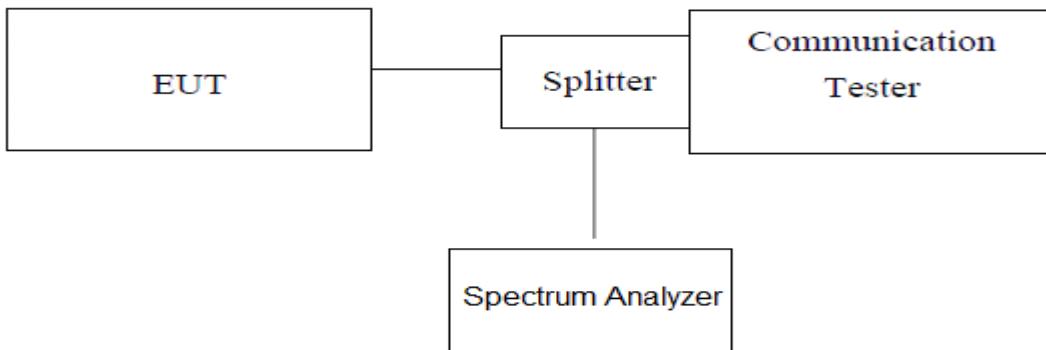
4.5. Spurious Emission on Antenna Port

TEST APPLICABLE

The following steps outline the procedure used to measure the conducted emissions from the EUT.

1. Determine frequency range for measurements: From CFR 2.1057 the spectrum should be investigated from the lowest radio frequency generated in the equipment up to at least the 10th harmonic of the carrier frequency. For the equipment of PCS1900 band, this equates to a frequency range of 9 KHz to 19.1 GHz, data taken from 9 KHz to 25 GHz. For GSM850, data taken from 9 KHz to 9 GHz.
2. The sweep time is set automatically by instrument itself. That should be the optimal sweep time for the span and the RBW. If the sweep time is too short, that is sweep is too fast, the sweep result is not accurate; if the sweep time is too long, that is sweep is too low, some frequency components may be lost. The instrument will give an optimal sweep time according the selected span and RBW.
3. The procedure to get the conducted spurious emission is as follows:
The trace mode is set to MaxHold to get the highest signal at each frequency;
Wait 25 seconds;
Get the result.
4. Determine EUT transmit frequencies: below outlines the band edge frequencies pertinent to conducted emissions testing.

TEST CONFIGURATION



Note: Measurement setup for testing on Antenna connector

TEST PROCEDURE

1. The EUT was set up for the max output power with pseudo random data modulation;
2. These measurements were done at 3 frequencies, 1850.20 MHz, 1880.00 MHz and 1909.80 MHz for PCS1900 band; 824.20 MHz, 836.60 MHz and 848.80 MHz for GSM850 band. (Low, middle and high of operational frequency range).
3. Set RBW=1 MHz, VBW=3 MHz, Dector: Peak;

TEST LIMIT

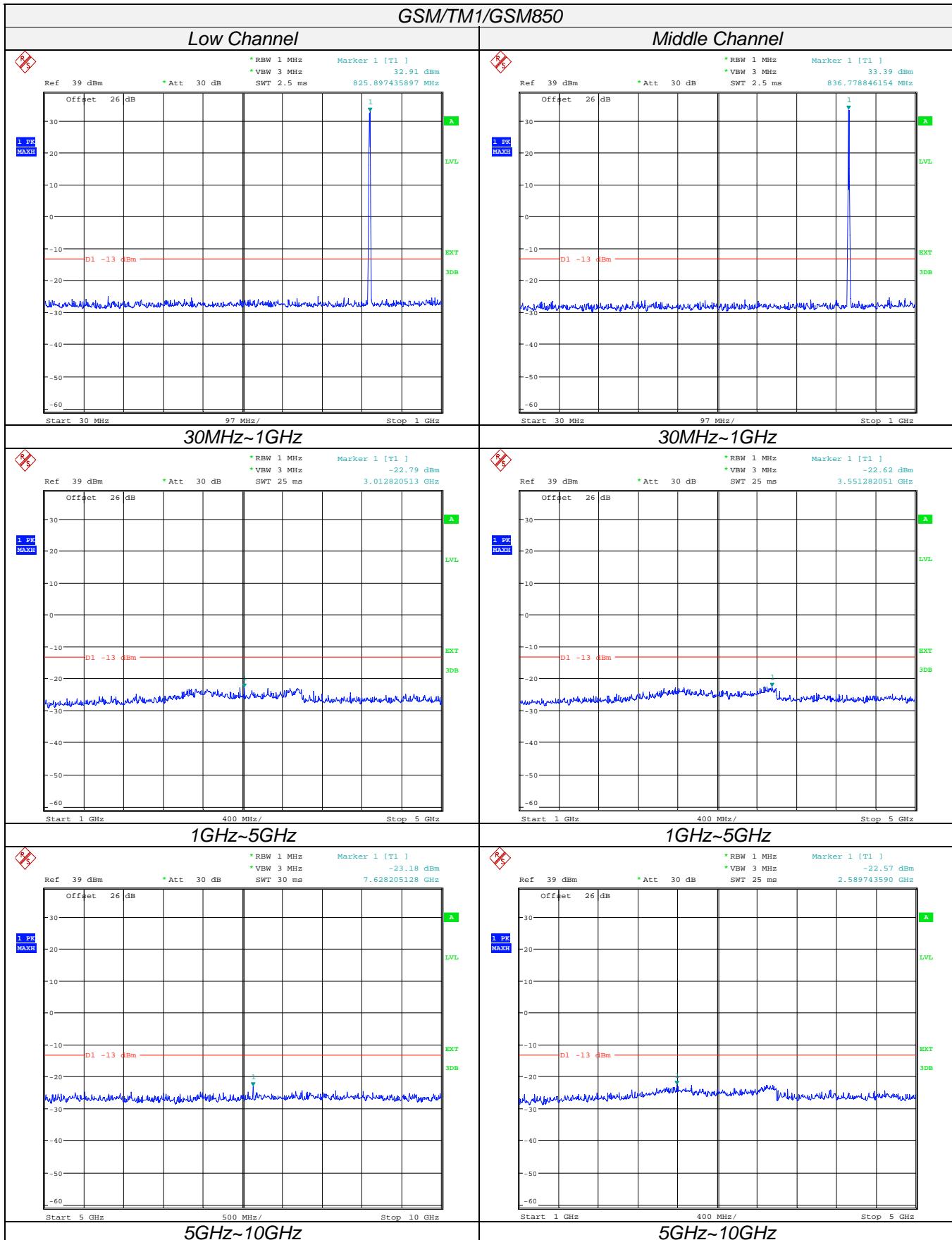
Part 24.238 and Part 22.917 specify that the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

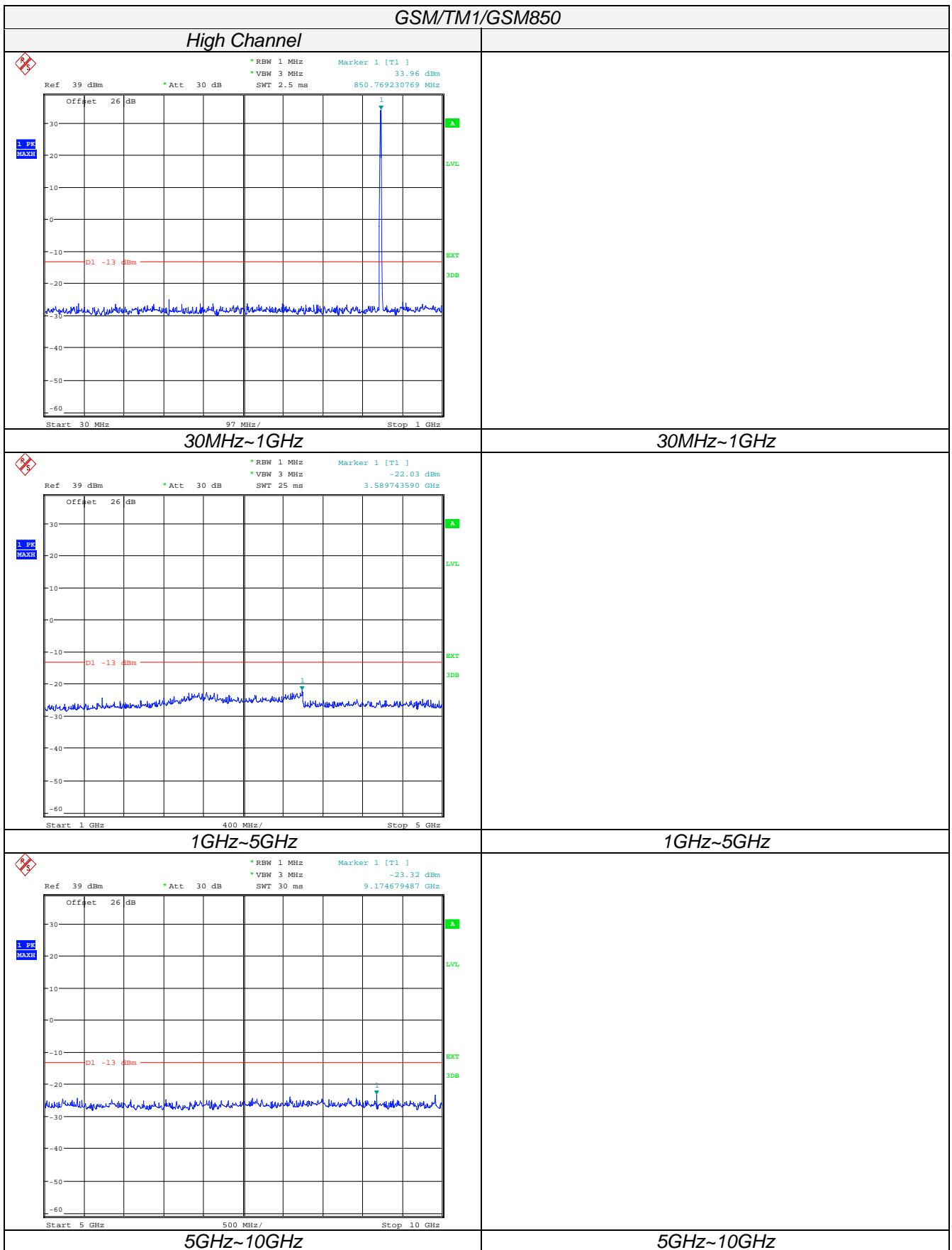
The specification that emissions shall be attenuated below the transmitter power (P) by at least $43 + 10 \log(P)$ dB, translates in the relevant power range (1 to 0.001 W) to -13 dBm. At 1 W the specified minimum attenuation becomes 43 dB and relative to a 30 dBm (1 W) carrier becomes a limit of -13 dBm. At 0.001 W (0 dBm) the minimum attenuation is 13 dB, which again yields a limit of -13 dBm. In this way a translation of the specification from relative to absolute terms is carried out.

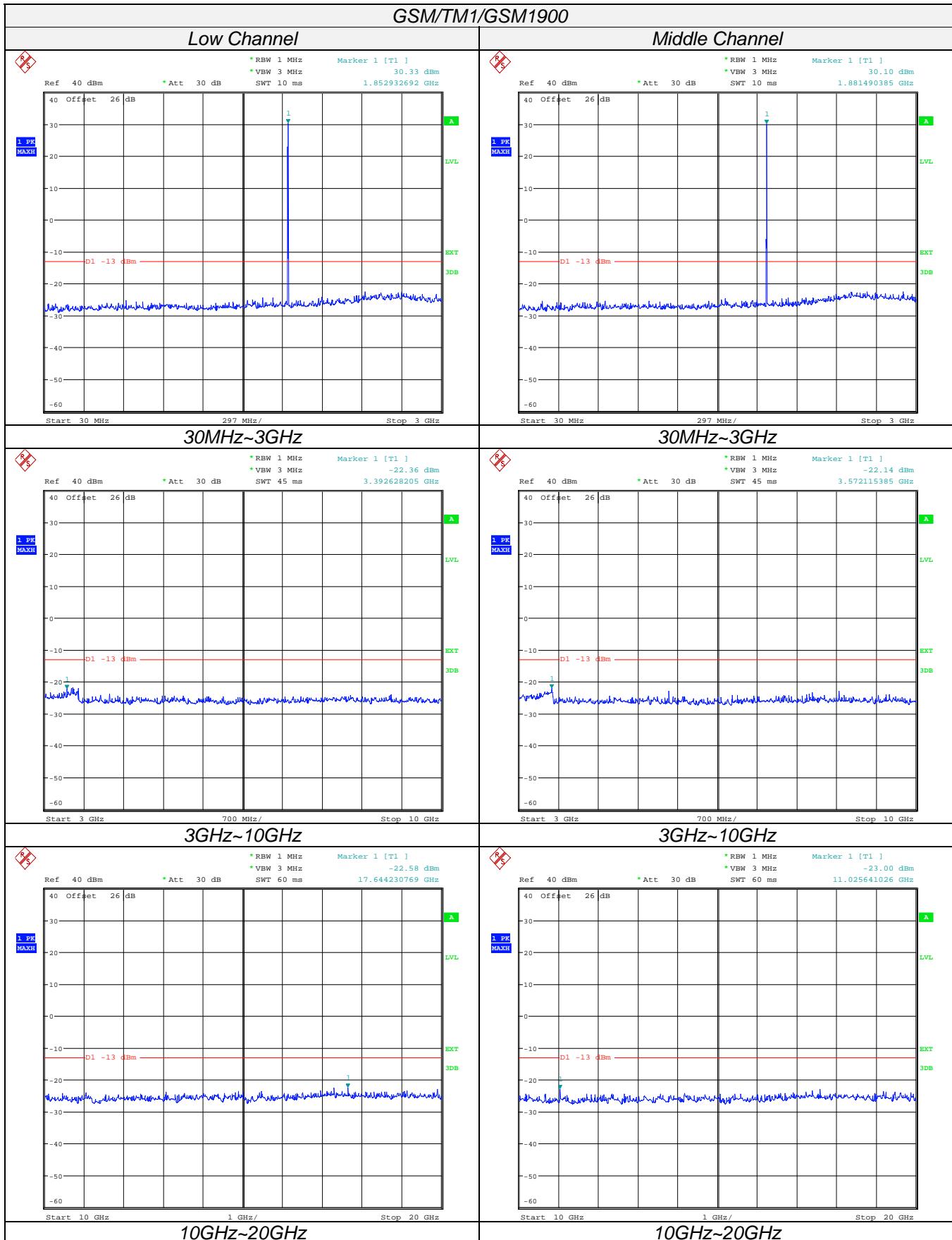
TEST RESULTS

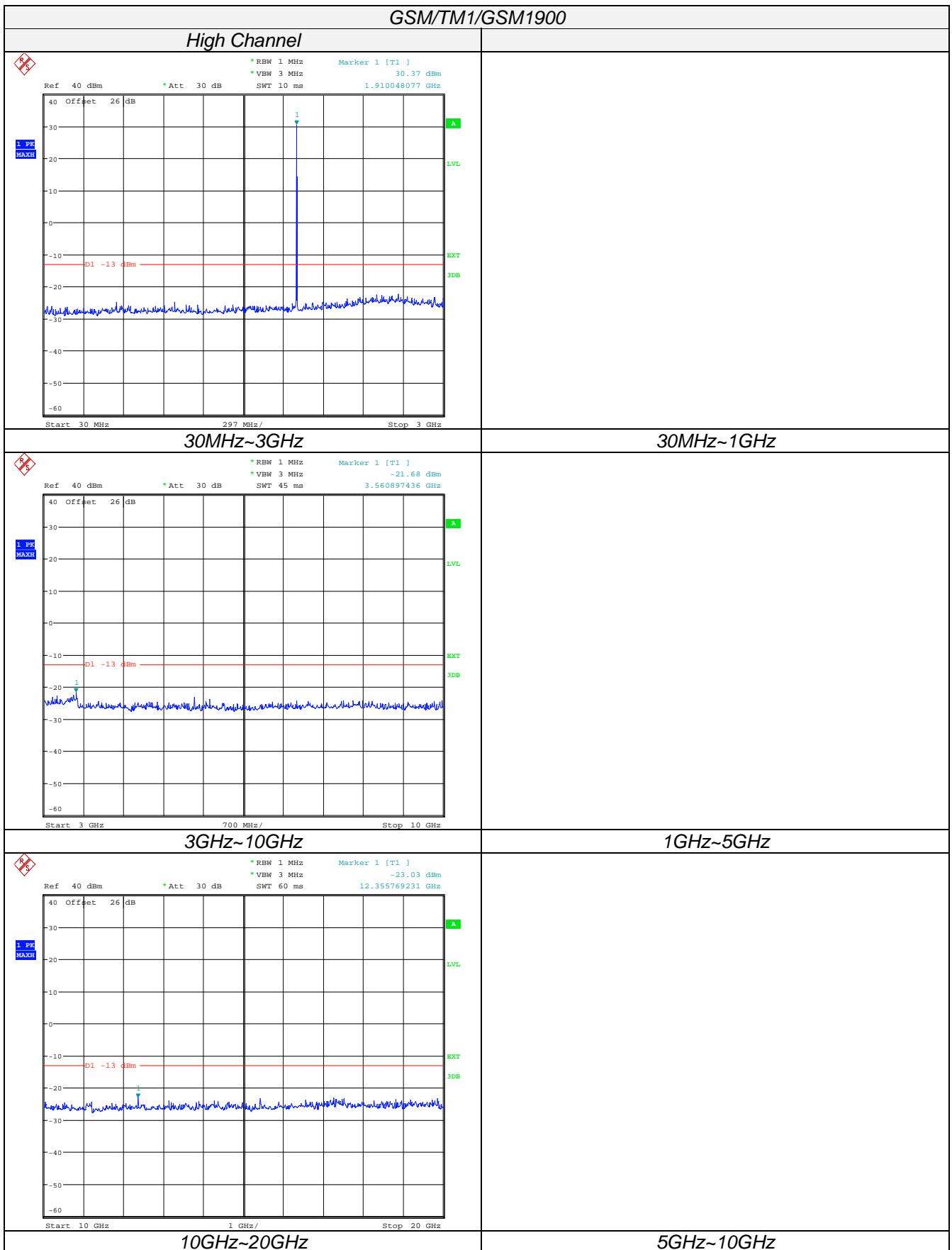
Remark:

1. We tested conducted spurious from 9KHz to 10th harmonic of the carrier frequency, and only recorded from 30MHz to 10th harmonic of the carrier frequency.
2. The test results including the cable lose.









4.6. Frequency Stability Test

TEST APPLICABLE

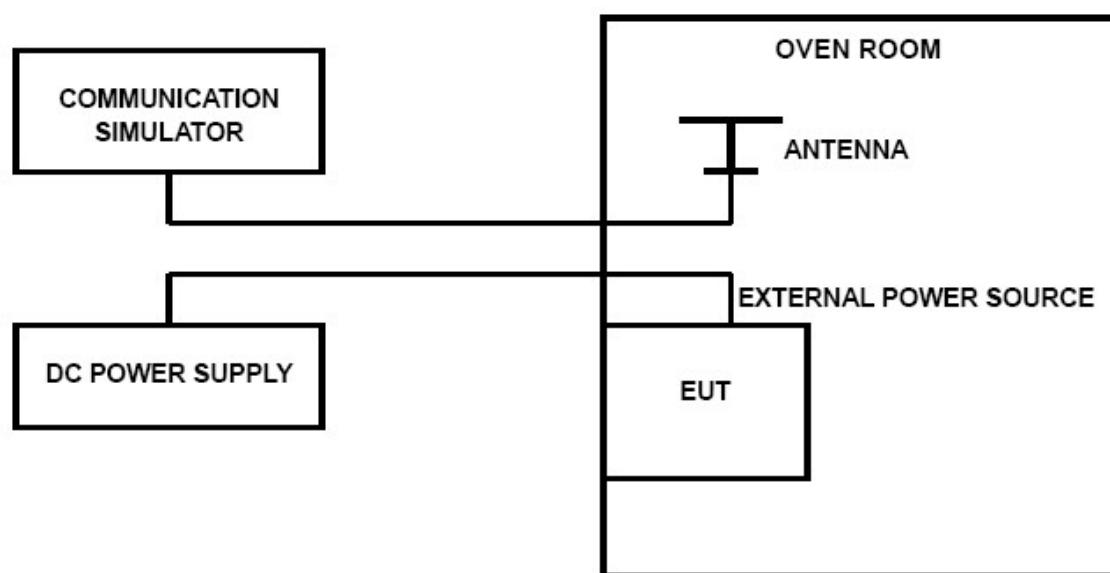
1. According to FCC Part 2 Section 2.1055 (a)(1), the frequency stability shall be measured with variation of ambient temperature from -30°C to +50°C centigrade.
2. According to FCC Part 2 Section 2.1055 (E) (2), for battery powered equipment, the frequency stability shall be measured with reducing primary supply voltage to the battery operating end point, which is specified by the manufacturer.

TEST PROCEDURE

In order to measure the carrier frequency under the condition of AFC lock, it is necessary to make measurements with the EUT in a "call mode". This is accomplished with the use of R&S CMU200 DIGITAL RADIO COMMUNICATION TESTER.

1. Measure the carrier frequency at room temperature;
2. Subject the EUT to overnight soak at -30°C;
3. With the EUT, powered via nominal voltage, connected to the CMU200 and in a simulated call on middle channel of PCS 1900 and GSM850, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming;
4. Repeat the above measurements at 10°C increments from -30°C to +50°C. Allow at least 0.5 hours at each temperature, unpowered, before making measurements;
5. Remeasure carrier frequency at room temperature with nominal voltage. Vary supply voltage from minimum voltage to maximum voltage, in 0.1 Volt increments remeasuring carrier frequency at each voltage. Pause at nominal voltage for 0.5 hours unpowered, to allow any self-heating to stabilize, before continuing;
6. Subject the EUT to overnight soak at +50°C;
7. With the EUT, powered via nominal voltage, connected to the CMU200 and in a simulated call on the centre channel, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming;
8. Repeat the above measurements at 10°C increments from +50°C to -30°C. Allow at least 0.5 hours at each temperature, unpowered, before making measurements;
9. At all temperature levels hold the temperature to +/- 0.5°C during the measurement procedure;

TEST CONFIGURATION



TEST LIMITS

For Hand carried battery powered equipment

According to the JTC standard the frequency stability of the carrier shall be accurate to within 0.1 ppm of the received frequency from the base station. This accuracy is sufficient to meet Sec. 24.235, Frequency Stability. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. As this transceiver is considered "Hand carried, battery powered equipment" Section 2.1055(d)(2) applies. This requires that the lower voltage for frequency stability testing be specified by the

manufacturer. This transceiver is specified to operate with an input voltage of between 3.00VDC and 4.35VDC, with a nominal voltage of 3.70VDC. Operation above or below these voltage limits is prohibited by transceiver software in order to prevent improper operation as well as to protect components from overstress. These voltages represent a tolerance of -10 % and +12.5 %. For the purposes of measuring frequency stability these voltage limits are to be used.

For equipment powered by primary supply voltage

According to the JTC standard the frequency stability of the carrier shall be accurate to within 0.1 ppm of the received frequency from the base station. This accuracy is sufficient to meet Sec. 24.235, Frequency Stability. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. For this EUT section 2.1055(d)(1) applies.

TEST RESULTS

GSM/TM1/GSM850					
DC Power	Temperature (°C)	Frequency error (Hz)	Frequency error (ppm)	Limit (ppm)	Verdict
3.00(end point)	25	55	0.07	2.50	PASS
3.70	25	47	0.06	2.50	PASS
4.35	25	38	0.05	2.50	PASS
3.70	-30	54	0.06	2.50	PASS
3.70	-20	48	0.06	2.50	PASS
3.70	-10	36	0.04	2.50	PASS
3.70	0	56	0.07	2.50	PASS
3.70	10	49	0.06	2.50	PASS
3.70	20	55	0.07	2.50	PASS
3.70	30	39	0.05	2.50	PASS
3.70	40	24	0.03	2.50	PASS
3.70	50	43	0.05	2.50	PASS

GSM/TM1/PCS1900					
DC Power	Temperature (°C)	Frequency error (Hz)	Frequency error (ppm)	Limit (ppm)	Verdict
3.00(end point)	20	42	0.02	2.50	PASS
3.70	20	41	0.02	2.50	PASS
4.35	20	38	0.02	2.50	PASS
3.70	-30	36	0.02	2.50	PASS
3.70	-20	45	0.02	2.50	PASS
3.70	-10	33	0.02	2.50	PASS
3.70	0	29	0.02	2.50	PASS
3.70	10	41	0.02	2.50	PASS
3.70	20	56	0.03	2.50	PASS
3.70	30	47	0.03	2.50	PASS
3.70	40	54	0.03	2.50	PASS
3.70	50	53	0.03	2.50	PASS

GSM/TM3/EGPRS850					
DC Power	Temperature (°C)	Frequency error (Hz)	Frequency error (ppm)	Limit (ppm)	Verdict
3.00(end point)	20	44	0.05	2.50	PASS
3.70	25	65	0.08	2.50	PASS
4.35	25	37	0.04	2.50	PASS
3.70	-30	75	0.09	2.50	PASS
3.70	-20	56	0.07	2.50	PASS
3.70	-10	47	0.06	2.50	PASS
3.70	0	45	0.05	2.50	PASS
3.70	10	37	0.04	2.50	PASS
3.70	20	34	0.04	2.50	PASS
3.70	30	64	0.08	2.50	PASS
3.70	40	35	0.04	2.50	PASS
3.70	50	59	0.07	2.50	PASS

GSM/TM3/EGPRS1900					
DC Power	Temperature (°C)	Frequency error (Hz)	Frequency error (ppm)	Limit (ppm)	Verdict
3.00(end point)	20	38	0.02	2.50	PASS
3.70	20	65	0.03	2.50	PASS
4.35	20	34	0.02	2.50	PASS
3.70	-30	86	0.05	2.50	PASS
3.70	-20	45	0.02	2.50	PASS
3.70	-10	67	0.04	2.50	PASS
3.70	0	35	0.02	2.50	PASS
3.70	10	47	0.03	2.50	PASS
3.70	20	35	0.02	2.50	PASS
3.70	30	56	0.03	2.50	PASS
3.70	40	43	0.02	2.50	PASS
3.70	50	37	0.02	2.50	PASS

5. Test Setup Photos of the EUT

Please refer to separated files for Test Setup Photos of the EUT.

6. External Photos of the EUT

Please refer to separated files for External Photos of the EUT.

7. Internal Photos of the EUT

Please refer to separated files for Internal Photos of the EUT.

.....**End of Report**.....