FCC Radio Test Report

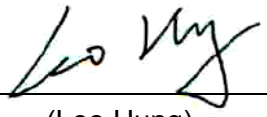
FCC ID: 2AEU7-LONDON

This report concerns (check one): ☒Original Grant ☐Class II Change

Project No.	:	1504C209
Equipment	:	Marshall London
Model Name	:	KB-1501
Applicant	:	Zound Industries Smartphones AB
Address	:	Torsgatan 2, 111 23 Stockholm, Sweden

Date of Receipt	:	Apr. 22, 2015
Date of Test	:	Apr. 22, 2015 ~ May 25, 2015
Issued Date	:	May 26, 2015
Tested by	:	BTL Inc.

Testing Engineer : (David Mao)

Technical Manager :  (Leo Hung)

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Declaration

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REPORT ISSUED HISTORY

Issued No.	Description	Issued Date
BTL-FCCP-5-1504C209	Original Issue.	May 26, 2015

1. CERTIFICATION

Equipment	:	Marshall London
Brand Name	:	Marshall
Model Name	:	KB-1501
Applicant	:	Zound Industries Smartphones AB
Manufacturer	:	Zound Industries Smartphones AB
Address	:	Torsgatan 2, 111 23 Stockholm, Sweden
Factory	:	Huizhou BYD Electronics Co., Ltd.
Address	:	Xiangshui River, Economic Development Zone, Daya Bay, Huizhou, Guangdong, 516083, P.R.China
Date of Test	:	Apr. 22, 2015 ~ May 25, 2015
Test Sample	:	ENGINEERING SAMPLE
Standard(s)	:	47 CFR FCC Part 22 Subpart H &ANSI/ C63.4 : 2009 47 CFR FCC Part 2 &ANSI/TIA-603-C-2004

The above equipment has been tested and found compliance with the requirement of the relative standards by BTL Inc.
The test data, data evaluation, and equipment configuration contained in our test report (Ref No. BTL-FCCP-5-1504C209) were obtained utilizing the test procedures, test instruments, test sites that has been accredited by the Authority of TAF according to the ISO-17025 quality assessment standard and technical standard(s).

Test result included in this report is only for the GSM 850MHz approvalpart of the product.

2. SUMMARY OF TEST RESULTS

Test procedures according to the technical standard(s):

FCC Part 22 Subpart H& Part 2			
Standard(s) Section FCC	Test Item	Judgment	Remark
2.1047(d)	Modulation Characteristics	PASS	
2.1046 22.913(a)	Radiated RF Output	PASS	
2.1049(h) 22.917(a)	99% Occupied Bandwidth	PASS	
2.1051 22.917(a)	Spurious Emissions at Antenna Terminal	PASS	
2.1053 22.917(a)	Spurious Radiated Emissions	PASS	
22.917(a)	Band Edge Emissions	PASS	
2.1055 22.355	Frequency Stability	PASS	
15.207	Conducted Emission	PASS	

NOTE:

(1)" N/A" denotes test is not applicable in this test report

2.1 TEST FACILITY

The test facilities used to collect the test data in this report is at the location of No.3,Jinshagang 1st Road, Shixia, Dalang Town, Dongguan, Guangdong, China.
BTL's test firm number for FCC: 319330

2.2 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimatedfor tests performed on the EUT as specified in CISPR 16-4-2. The BTL measurement uncertainty is less than the CISPR 16-4-2 U_{cispr} requirement.

The reported uncertainty of measurement **y** ± **U**, where expanded uncertainty **U** is based on astandard uncertainty multiplied by a coverage factor of **k=2**, providing a level of confidence of approximately **95**% ◦

A. Conducted Measurement :

Test Site	Method	Measurement Frequency Range	U,(dB)	Note
DG-C02	CISPR	150 KHz~30MHz	1.94	

B. Radiated Measurement :

Test Site	Parameter	Uncertainty
DG-CB12	All emissions, radiated	±6 dB

Note: Unless specifically mentioned, the uncertainty of measurement has not been taken into account to declare the compliance or non-compliance to the specification.

3. GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

Equipment	Marshall London	
Brand Name	Marshall	
Model Name	KB-1501	
Model Difference	N/A	
Product Description	Operation Frequency:	TX:824.2MHz~848.8MHz RX:869.2MHz~893.8MHz
	Modulation Type:	GMSK;8-PSK
	ERP Output Power	20.38dBm
PowerSource	#1 DC voltage supplied from AC adapter. Manufacturer/Model: BYD/BUUS050100-B01 #2 Supplied from Li-ion battery. Manufacturer/Model: BYD/M62	
Power Rating	#1 I/P: AC 100-240V 50/60Hz 200mA O/P: DC 5V 1A #2 DC 3.8V 2500mAh	

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.
2. Channel List:

Band	Channel	Frequency (MHz)	
824.2MHz~848.8MHz	128	Low	824.2
	190	Mid	836.6
	251	High	848.8

3. Table for Filed Antenna @GSM850:

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	SPEED	LF4701Q-EU	Internal	N/A	-1.46

3.2 DESCRIPTION OF TEST MODES

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Test Items	Worst TX Mode	Channel
Radiated RF Output	GSM/EDGE	128/190/251
Spurious Radiated Emissions	GSM/EDGE	128/190/251
Band Edge	GSM/GPRS/EDGE	128/251
Frequency Stability	GSM/EDGE	128
99% Occupied Bandwidth	GSM/GPRS/EDGE	128/190/251
Spurious Emissions at Antenna Terminal	GSM	128/190/251

For Conducted Emission	
Final Test Mode	Description
Mode 1	TX Mode

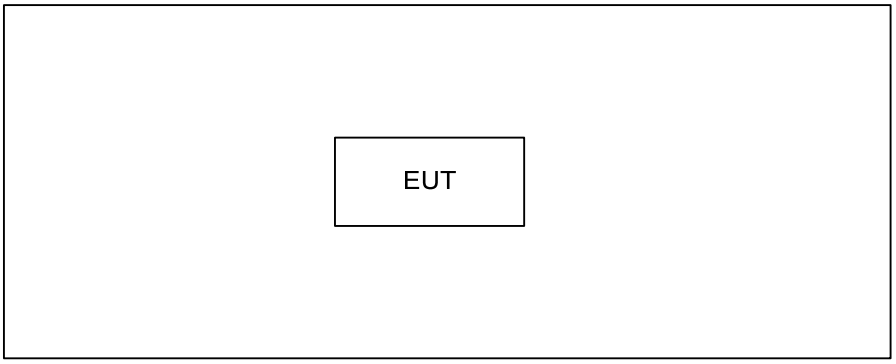
Note:

(1) The measurements are performed at the highest, middle, lowest available channels.

(2) The EUT is considered a portable unit; it was pre-tested on the positioned of each 3 axis. The worst case was found positioned on X-plane. Therefore only the test data of this X-plane was used for radiated emission measurement test.

(3) Both adapter and battery are evaluated, operated the battery is the worst and recorded as below test data.

3.3 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED



3.4 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Item	Equipment	Mfr/Brand	Model/Type No.	FCC ID	Series No.	Note
-	-	-	-	-	-	

Item	Shielded Type	Ferrite Core	Length	Note
-	-	-	-	

4. TEST RESULT

4.1 RADIATEDRF OUTPUT POWER MEASUREMENT

4.1.1 LIMIT

The Radiated Peak Output Power shall be according to the specific rule Part 22.913(a) that “Mobile/Portable station are limited to 7 watts e.r.p.” and 22.913(a) specifed that “Peak transmit power must be measure over any interval of continuous transmission using instrumentation calibration in terms of rms-equivalent voltage.

4.1.2 MEASURING INSTRUMENTS AND SETTING

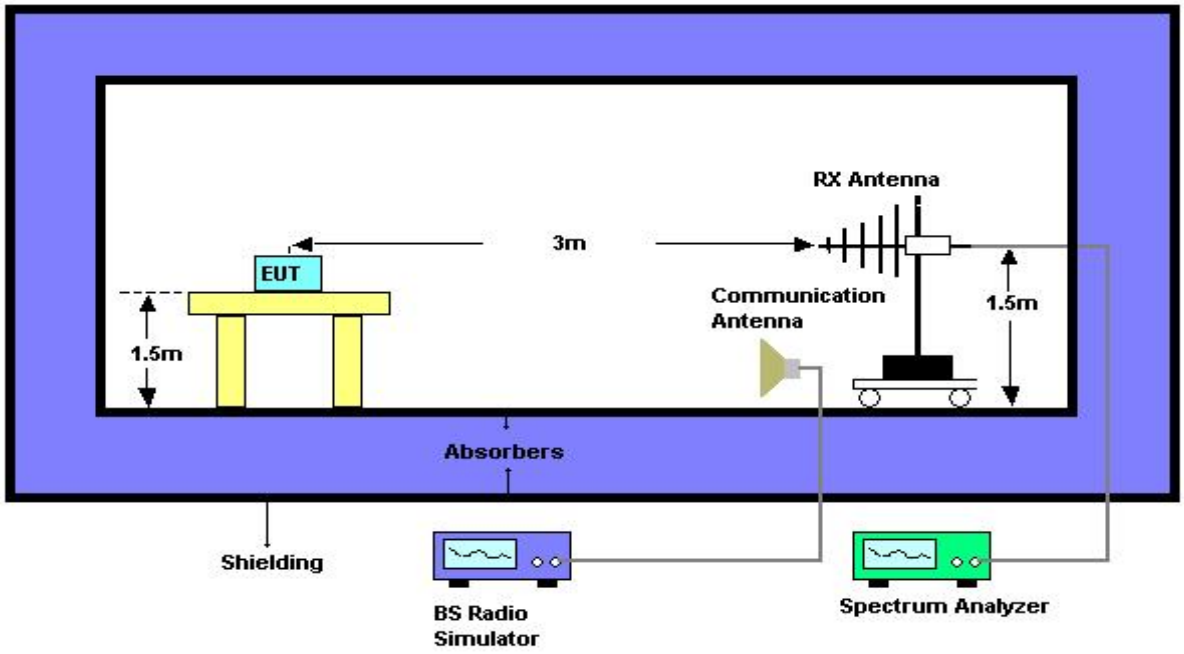
Please refer to section 5 in this report. The following table is the setting of the Spectrum Analyzer.

Spectrum Parameters	Setting
Attenuation	Auto
Center Frequency	Low / middle / high channels
Span Frequency	10MHz
RB / VB	3MHz / 3MHz for Peak

4.1.3 TEST PROCEDURE

1. The EUT was set up for the maximum peak power with GSM/EDGE link data modulation. The power was measured with R&S Spectrum Analyzer. All measurements were done at 3 channels, 128, 190 and 251 (low, middle and high operational frequency range).
2. The conducted peak output power used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer. The path loss included the splitter loss, cable loss and 20dB pad loss. The spectrum set RB/VB 3MHz,then read peak power value and record to the test. (All transmitted path loss shall be considered in the test report data)
3. E.I.R.P peak power measurement. In the fully anechoic chamber, EUT placed on the1.5mheight of Turn Table, rotated the table around 360 degrees to search the maximum radiation powerand receiver antenna shall be rotated vertical and horizontal polarization to find the maximum polar radiated power. The “Read Value” is the spectrum reading the maximum power value.
4. The substitution horn antennais substituted for EUT at the same position, and signal generator export the CW signal to the calibration antenna. Rotated the Turn Table to find the maximum radiation power. “Raw” is the spectrum reading value, “SG” is signal generator export power, “TX Gain” is calibration antenna isotropic gain value, “TX cable” is the transmitted cable loss between the calibration antenna and signal generator. The “Factor” means that the transmission path loss is equal to “SG” - “TX cable” + “TX Gain”–“Raw”.
5. Actually the real E.I.R.P peak power is equal to “Read Value” + “Factor”
6. E.R.P power can be calculated form E.I.R.P power by subtracting the gain of Integral, E.R.P power=E.I.P.R power-2.14dBi.

4.1.4TESTSETUP LAYOUT
ERP Power Measurement



4.1.5 TESTDEVIATION

There is no deviation with the original standard.

4.1.6EUT OPERATIONDURING TEST

The BS simulator was used to set the TX channel and power level and modulate the TX signal.

4.1.7EUT TEST CONDITIONS

Temperature: 25°C
Relative Humidity: 55%
Test Voltage:DC 3.8V

4.1.8TEST RESULTS

Please refer to the Attachment A.

4.299% OCCUPIED BANDWIDTH MEASUREMENT

4.2.1LIMIT

According to FCC 2.1049(h) specified that emission bandwidth is defined as thewidth of the signal between two points,one below the carrier center frequencyand one above the carrier center frequency,outside of which all emissionsare attenuated at least 26 dB below thetransmitter power.

4.2.2 MEASURING INSTRUMENTS AND SETTING

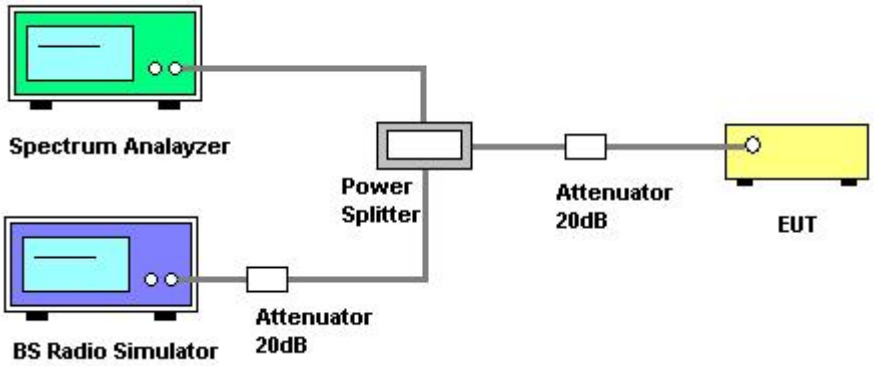
Please refer to section 5 in this report. The following table is the setting of the Spectrum Analyzer.

Spectrum Parameters	Setting
Attenuation	Auto
Span Frequency	Encompass the entire emissions bandwidth (EBW) ofthe signal
RB	30 kHz
VB	100 kHz
Trace	Max Hold

4.2.3 TEST PROCEDURE

1. The transmitter output (antenna port) was connected to the spectrum analyzer.
2. Used measurement function of spectrum to measure the 99% occupied bandwidth..

4.2.4TESTSETUP LAYOUT



4.2.5 TESTDEVIATION

There is no deviation with the original standard.

4.2.6EUT OPERATIONDURING TEST

The BS simulator was used to set the TX channel and power level and modulate the TX signal.

4.2.7EUT TEST CONDITIONS

Temperature: 25°C
Relative Humidity: 55%
Test Voltage: DC 3.8V

4.2.8TEST RESULTS

Please refer to the Attachment B.

4.3SPURIOUS EMISSIONS AT ANTENNA TERMINALS MEASUREMENT

4.3.1LIMIT

In the FCC 22.917(a), on any frequency outside a licensee'sfrequency block within GSM spectrum, the power of anyemission shall be attenuated below thetransmitter power (P) by at least 43 +10 log (P) dB. The limit translates in the relevant power range (2 to 0.003W). At 2W(Power Control Level 5) the specified minimum attenuation becomes 43dB and the limit of emission equal to –13dBm

4.3.2 MEASURING INSTRUMENTS AND SETTING

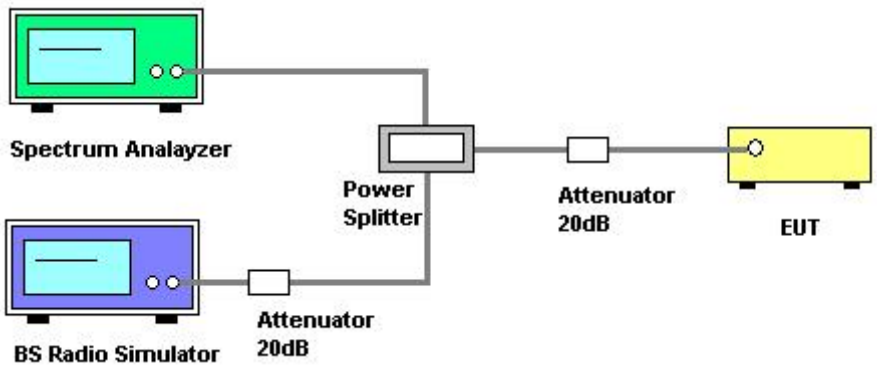
Please refer to section 5 in this report. The following table is the setting of the Spectrum Analyzer.

Spectrum Parameters	Setting
Attenuation	Auto
Start Frequency	30MHz
Stop Frequency	10th carrier harmonic
RB / VB	1 MHz / 1MHz for Peak

4.3.3 TEST PROCEDURES

1. The EUT was set up for the maximum peak power with **GSM/EDGE** link data modulation. The power was measured with R&S Spectrum Analyzer. All measurements were done at 3 channels, 128, 190 and 251(low, middle and high operational frequency range.)
2. The conducted spurious emission used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer. This splitter loss and cable loss are the worst loss 4dB in the transmitted path track.
3. When the spectrum scanned from 30MHz to 3GHz, it shall be connected to the band reject filter attenuated the carried frequency. The spectrum set RB/VB 1MHz.
4. When the spectrum scanned from 3GHz to 10GHz, it shall be connected to the high pass filter attenuated the carried frequency. The spectrum set RB/VB 1MHz.

4.3.4TESTSETUP LAYOUT



4.3.5 TESTDEVIATION

There is no deviation with the original standard.

4.3.6EUT OPERATIONDURING TEST

The BS simulator was used to set the TX channel and power level and modulate the TX signal.

4.3.7EUT TEST CONDITIONS

Temperature: 25°C
Relative Humidity: 55%
Test Voltage:DC 3.8V

4.3.8TEST RESULTS

Please refer to the Attachment C.

4.4SPURIOUS RADIATED EMISSIONS MEASUREMENT

4.4.1LIMIT

Out of band emissions, The power of any emissions 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. In the 1 MHz bands immediately outside the frequency block. The spurious emissions of limit equal to –13dBm.

4.4.2 MEASURING INSTRUMENTS AND SETTING

Please refer to section 5 in this report. The following table is the setting of the Spectrum Analyzer.

Spectrum Parameters	Setting
Attenuation	Auto
Start Frequency	30 MHz
Stop Frequency	10th carrier harmonic
Detector	Positive Peak
Span	100 MHz
Sweep Time	1s
RB / VB	1 MHz / 1MHz
Attenuation	Positive Peak

4.4.3 TEST PROCEDURES

1. The EUT was placed on the top of the turntable in fully anechoic chamber.
2. The test shall be made in the transmitting mode. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. This measurement shall be repeated with the transmitter in standby mode where applicable.
4. For 30~1000MHz spurious emissions measurement, the broad band bi-log receiving antenna was placed 3 meters far away from the turntable. For 1~10th carrier harmonic measurement, the receiving Horn antenna was placed 1.5 meters far away from the turntable.
5. The broadband receiving antenna was fixed on the same height with the EUT to find each suspected emissions of both horizontal and vertical polarization. Each recorded suspected value is indicated as Read Level (Raw).
6. Replace the EUT by standard antenna and feed the RF port by signal generator.
7. Adjust the frequency of the signal generator to the suspected emission and slightly rotate the turntable to locate the position with maximum reading.
8. Adjust the power level of the signal generator to reach the same reading with Read Level (Raw).
9. The level of the spurious emission is the power level of (8) plus the gain of the standard antenna in dBi and minus the loss of the cable used between the signal generator and the standard antenna.

4.4.4TESTSETUP LAYOUT

This test setup layout is the same as that shown in section 4.2.4.

4.4.5 TESTDEVIATION

There is no deviation with the original standard.

4.4.6EUT OPERATIONDURING TEST

The BS simulator was used to set the TX channel and power level and modulate the TX signal.

4.4.7EUT TEST CONDITIONS

Temperature: 25°C
Relative Humidity: 55%
Test Voltage: DC 3.8V

4.4.8TEST RESULTS

Please refer to the Attachment D.

4.5BAND EDGE MEASUREMENT

4.5.1LIMIT

According to FCC 22.917(a) specified that power of any emission outside of the authorized operating frequency rangesmust be attenuated below the transmitting power (P) by a factor of at least 43 +10 log(P) dB . In the 1 MHz bands immediatelyoutside and adjacent to the frequencyblock a resolution bandwidth of atleast one percent of the emission bandwidthof the fundamental emission ofthe transmitter may be employed. Then we measure that the bandwidth is about 300kHz and the resolution bandwidth is 3kHz.

4.5.2 MEASURING INSTRUMENTS AND SETTING

Please refer to section 5 in this report. The following table is the setting of the Spectrum Analyzer.

Spectrum Parameters	Setting
Attenuation	Auto
Span Frequency	5 MHz
RB / VB	10 kHz /30 kHz
Trace	Sample
Sweep Time	Auto

4.5.3 TEST PROCEDURES

1. The EUT was set up for the maximum peak power with **GSM/EDGE** link data modulation. The power was measured with R&S Spectrum Analyzer. All measurements were done at 2 channels, 128 and 251(low and high operational frequency range.)
2. The band edge measurement used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer. The splitter loss and cable loss are the worst loss 4dB in the transmitted path track.
3. The center frequency of spectrum is the band edge frequency and span is 2 MHz. RB of the spectrum is 10kHz and VB of the spectrum is 30KHz.
4. Record the Sample trace plot into the test report.

4.5.4TESTSETUP LAYOUT

This test setup layout is the same as that shown in section 4.2.4.

4.5.5 TESTDEVIATION

There is no deviation with the original standard.

4.5.6EUT OPERATIONDURING TEST

The BS simulator was used to set the TX channel and power level and modulate the TX signal.

4.5.7EUT TEST CONDITIONS

Temperature: 25°C
Relative Humidity: 55%
Test Voltage: DC 3.8V

4.5.8TEST RESULTS

Please refer to the Attachment E.

4.6FREQUENCY STABILITY MEASUREMENT

4.6.1LIMIT

According to the FCC part 22.355 shall be tested the frequency stability. The rule is defined that" The frequency stability shall be sufficientto ensure that the fundamentalemission stays within the authorizedfrequency block." The frequency error rate is according to the JTC standard that the frequency error rate shall be accurate to within 2.5 ppm of the receivedfrequency from the base station. The test extreme voltage is according to the 2.1055(d)(1) Vary primary supply voltage from85 to 115 percent of the nominal valuefor other than hand carried batteryequipment and the extreme temperature rule is comply with the 2.1055(a)(1) –30℃~50℃.

4.6.2 MEASURING INSTRUMENTS AND SETTING

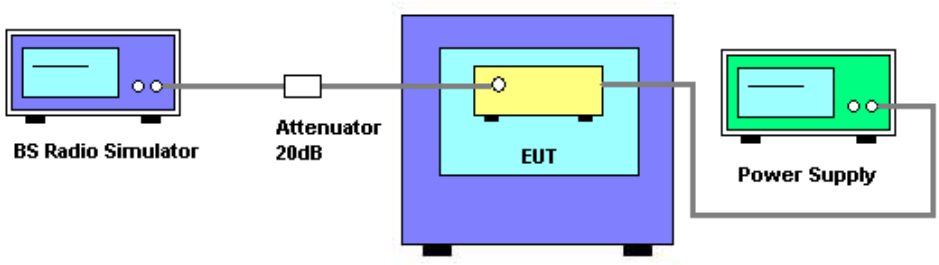
Please refer to section 5 in this report. The following table is the setting of the BS Simulator.

Spectrum Parameters	Setting
Frequency Error	The maximum of transmit frequency error

4.6.3 TEST PROCEDURES

1. The transmitter output (antenna port) was connected to the BS Simulator.
2. The BS simulator was used to set the TX channel and power level and modulate the TX signal with different bit patterns.
3. BS simulator used the frequency error function and measured the peak frequency error. Power must be removed when changingfrom one temperature to another or one voltage to another voltage. Power warm up is at least 15 min and power applied should perform before recording frequency error.
   The each temperature step shall be at least 0.5 hours, consider the EUT could be test under the stability condition.
4. EUT is connected the external power supply to control the DC input power. The various Volts from the minimum 3.1 Volts to 4.3 Volts. Each step shall be record the frequency error rate.
5. The test extreme voltage is to change the primary supply voltage from 85 to 115 percent of the nominal value.
6. Extreme temperature rule is 0°C~40°C.

4.6.4TESTSETUP LAYOUT



4.6.5 TESTDEVIATION

There is no deviation with the original standard.

4.6.6EUT OPERATIONDURING TEST

The EUT was programmed to be in continuously un-modulation transmitting mode.

4.6.7EUT TEST CONDITIONS

Temperature: 25°C
Relative Humidity: 55%
Test Voltage: DC 3.8V

4.6.8TEST RESULTS

Please refer to the Attachment F.

4.7 CONDUCTED EMISSION MEASUREMENT

4.7.1 POWER LINE CONDUCTED EMISSION Limits (Frequency Range 150KHz-30MHz)

FREQUENCY (MHz)	Class A (dBuV)		Class B (dBuV)		Standard
	Quasi-peak	Average	Quasi-peak	Aver ge	
0.15 -0.5	79.00	66.00	66 - 56 *	56 - 46 *	CISPR
0.50 -5.0	73.00	60.00	56.00	46.00	CISPR
5.0 -30.0	73.00	60.00	60.00	50.00	CISPR

0.15 -0.5	79.00	66.00	66 - 56 *	56 - 46 *	FCC
0.50 -5.0	73.00	60.00	56.00	46.00	FCC
5.0 -30.0	73.00	60.00	60.00	50.00	FCC

Note:

(1) The tighter limit applies at the band edges.

(2) The limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

(3) The test result calculated as following:
Measurement Value = Reading Level + Correct Factor
Correct Factor = Insertion Loss + Cable Loss + Attenuator Factor(if use)
Margin Level = Measurement Value - Limit Value

The following table is the setting of the receiver

Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

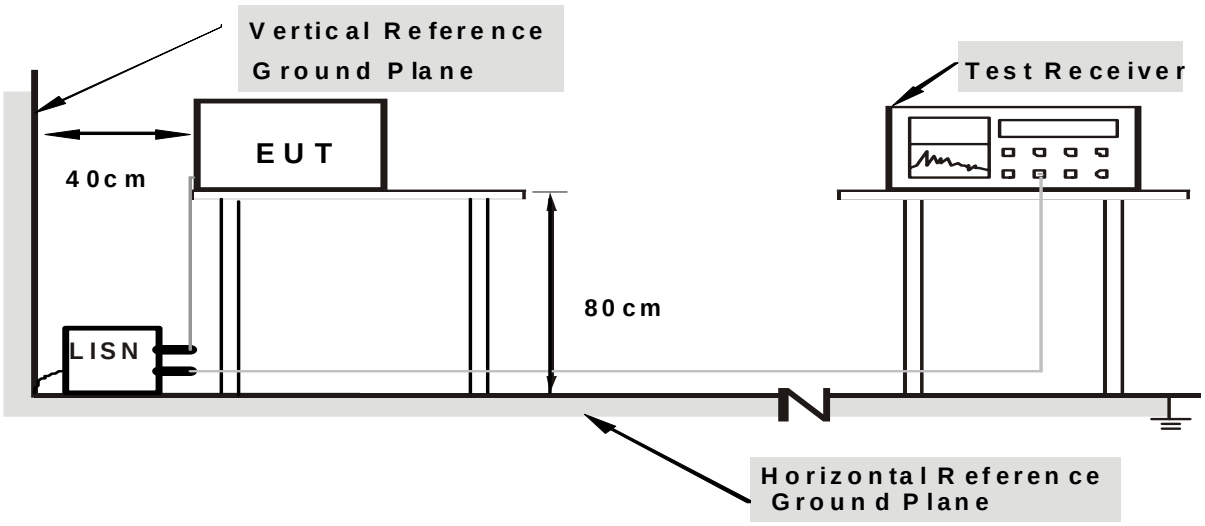
4.7.2 TEST PROCEDURE

a. The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipmentspowered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
b. Interconnecting cables that hang closer than 40 cm to the groundplane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
c. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
d. LISN at least 80 cm from nearest part of EUT chassis.
e. For the actual test configuration, please refer to the related Item –EUT Test Photos.

4.7.3DEVIATIONFROMTESTSTANDARD

No deviation

4.7.4 TESTSETUP



Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

4.7.5EUT OPERATING CONDITIONS

The EUT was configured for testing in a typical fashion (as a customer would normally use it).The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.

4.7.6EUT TEST CONDITIONS

Temperature: 25°C
Relative Humidity: 55%
Test Voltage: AC 120V/60Hz

4.6.9TEST RESULTS

Please refer to the Attachment G.

5. LIST OF MEASUREMENT EQUIPMENTS

Conducted Emission Measurement					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	LISN	EMCO	3816/2	00052765	Mar. 28, 2016
2	LISN	R&S	ENV216	101447	Mar. 28, 2016
3	Test Cable	N/A	C_17	N/A	Mar.13, 2016
4	EMI TEST RECEIVER	R&S	ESCS30	833364/017	Mar. 28, 2016
5	50Ω Terminator	SHX	TF2-3G-A	08122902	Mar. 28, 2016
6	Wireless Communication Test SET	（8960 Series ） Agilent	E5515C	MY48364183	Mar. 28, 2016
7	Measurement Software	Farad	EZ-EMC Ver.NB-03A1 -01	N/A	N/A

Radiated Emission Measurement					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	EXA Spectrum Analyzer	Agilent	N9010A	MY50520044	Mar. 28, 2016
2	Microwave Preamplifier With Adaptor	EMC INSTRUMENT	EMC012645B	980221	Oct. 22, 2015
3	Amplifier	Agilent	8449B	3008A02274	Nov. 02, 2015
4	Double Ridged Guide Antenna	ETS·LINDGREN	3115	00075846	Mar. 28, 2016
5	Antenna	SCHWARZBECK	VULB 9160	9160-3231	Mar. 28, 2016
6	Test Cable	N/A	CL-CB12-001	N/A	Oct. 22, 2015
7	Test Cable	N/A	CL-CB12-004	N/A	Oct. 22, 2015
8	Test Cable	N/A	CL-CB12-006	N/A	Oct. 22, 2015
9	Controller	CT	SC100	N/A	N/A
10	Wireless Communication Test SET	（8960 Series ） Agilent	E5515C	MY48364183	Mar. 15, 2016
11	Band Reject Filter	Wairrwright Instruments Gmbh	WRCG 1710/1785-1690/1805-60/12SS	38	Mar. 04, 2016
12	Band Reject Filter	Wairrwright Instruments Gmbh	WRCG 824/849-810/863-60/9SS	7	Mar. 04, 2016
13	Band Reject Filter	Wairrwright Instruments Gmbh	WRCG 880/915-860/935-60/9SS	14	Mar.04, 2016
14	Band Reject Filter	Wairrwright Instruments Gmbh	WRCG 1850/1910-1830/1930-60/10SS	17	Mar. 04, 2016

Antenna Conducted Spurious Emission Measurement					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP 40	100185	Nov. 02, 2015
2	Wireless Communication Test SET	（8960 Series ） Agilent	E5515C	MY48364183	Mar. 28, 2016

Band Edge Measurement					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP 40	100185	Nov. 02, 2015
2	Wireless Communication Test SET	（8960 Series ） Agilent	E5515C	MY48364183	Mar. 28, 2016

99% Occupied Bandwidth Measurement					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP 40	100185	Nov. 02, 2015
2	Wireless Communication Test SET	（8960 Series ） Agilent	E5515C	MY48364183	Mar. 28, 2016

Frequency Stability Measurement					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP 40	100185	Nov. 02, 2015
2	Wireless Communication Test SET	（8960 Series ） Agilent	E5515C	MY48364183	Mar. 28, 2016

Remark: ”N/A” denotes no model name, serial no. or calibration specified.
All calibration period of equipment list is one year.

ATTACHMENT A -RADIATED RF OUTPUT POWER

Test Mode:	TX CH 128/190/251

GSM 850

GSM 850		ERP Power(dBm)			Max. Limit(dBm)	Result
		Channel 128	Channel 190	Channel 251		
GSM	V	17.78	17.85	17.22	38.50	Complies
	H	20.38	20.01	19.68	38.50	Complies
EDGE	V	17.75	17.90	17.04	38.50	Complies
	H	20.37	20.01	19.65	38.50	Complies

GSM 850		Conducted Power(dBm)		
		Channel 128	Channel 190	Channel 251
GSM (CS)		32.30	32.49	32.56
GPRS (GMSK)	1 Tx Slot	32.42	32.41	32.46
	2 Tx Slot	29.84	29.85	29.92
	3 Tx Slot	27.33	27.41	27.60
	4 Tx Slot	24.46	24.94	25.02
EDGE (GMSK)	1 Tx Slot	32.21	32.31	32.46
	2 Tx Slot	29.58	29.76	30.09
	3 Tx Slot	27.38	27.54	27.71
	4 Tx Slot	24.90	24.87	25.03
EDGE (8PSK)	1 Tx Slot	25.81	26.02	26.07
	2 Tx Slot	23.67	24.09	24.06
	3 Tx Slot	21.91	22.04	22.09
	4 Tx Slot	18.92	19.16	19.12

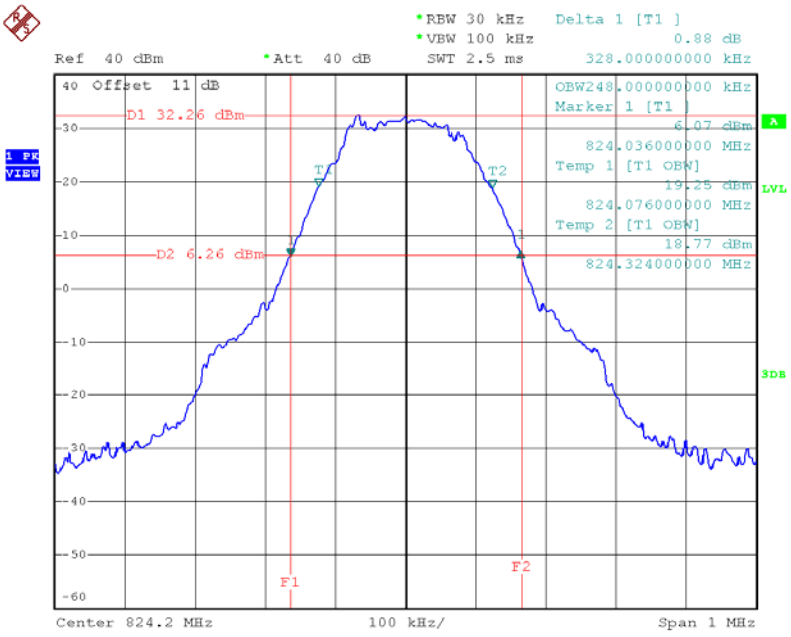
REMARKS:

1. Radiated Output Power(dBm)=Raw Value(dBm) + Correction Factor(dB) +Ant Gain(dBi)
2. Correction Factor(dB) = Power SplitterLoss(dB) + Cable Loss(dB)
3. The EUT does employ a power control function by which the output power is controlled from +30dBm to +19dBm (nominal) by 2dB steps. Consequently the EUT meets the requirement of Part22.913(a)
4. The antenna gain is –1.46dBi

ATTACHMENT B - 99% OCCUPIED BANDWIDTH

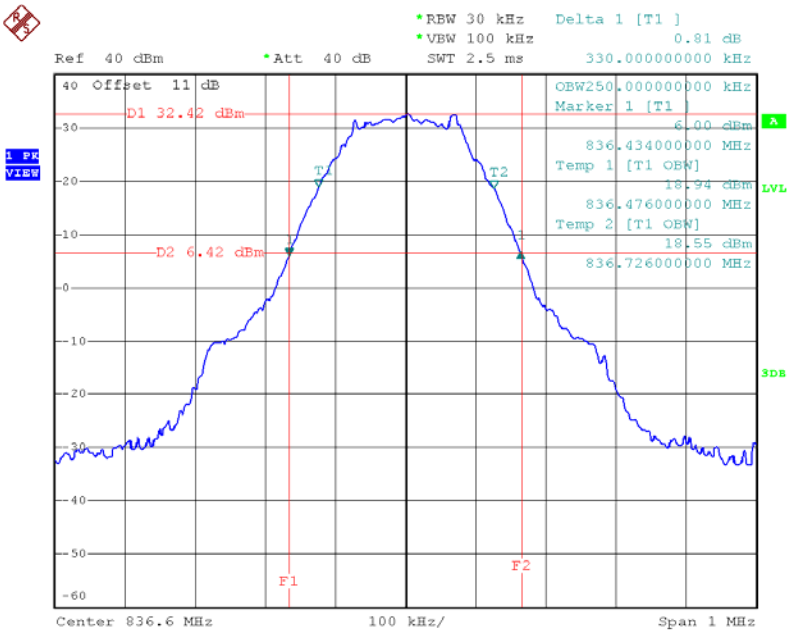
Test Mode : TX Mode Configuration GSM				
Channel	**Frequency**	**99% OBW (MHz)**	**-26dBc Bandwidth(MHz)**	**Result**
128	824.20 MHz	0.248	0.328	**Complies**
190	836.60 MHz	0.250	0.330	**Complies**
251	848.80 MHz	0.248	0.332	**Complies**

99% Occupied Bandwidth channel 128



Date: 27.APR.2015 11:06:42

99% Occupied Bandwidth channel 190



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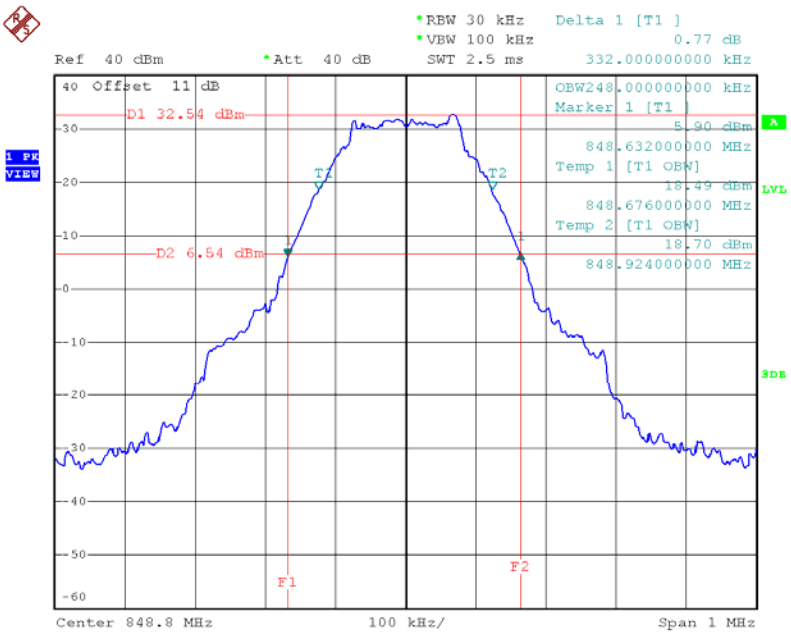
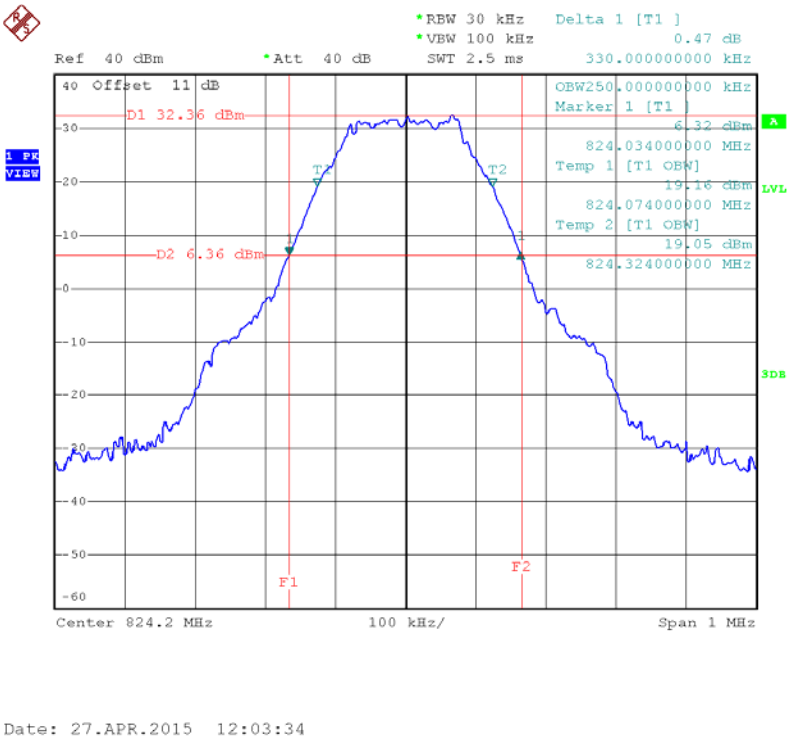
99% Occupied Bandwidth channel 251



Date: 27.APR.2015 11:20:39

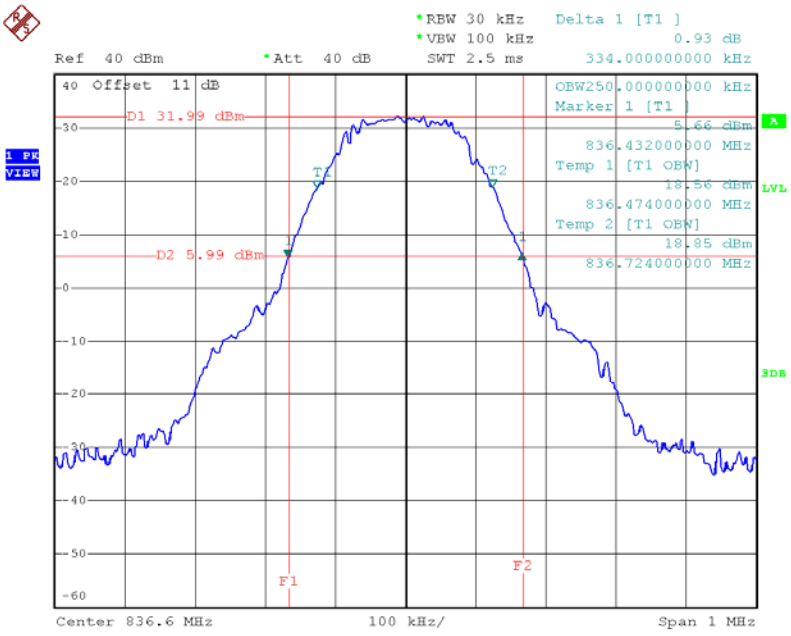
Test Mode : TX Mode Configuration GPRS				
Channel	**Frequency**	**99% OBW (MHz)**	**-26dBc Bandwidth(MHz)**	**Result**
128	824.20 MHz	0.250	0.330	**Complies**
190	836.60 MHz	0.250	0.334	**Complies**
251	848.80 MHz	0.246	0.332	**Complies**

99% Occupied Bandwidth channel 128



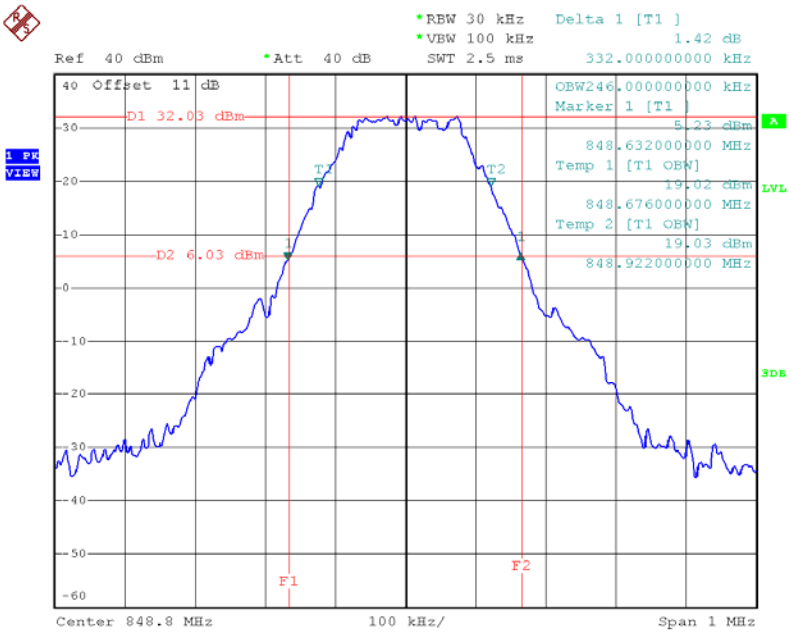
Date: 27.APR.2015 12:03:34

99% Occupied Bandwidth channel 190



Date: 27.APR.2015 12:07:16

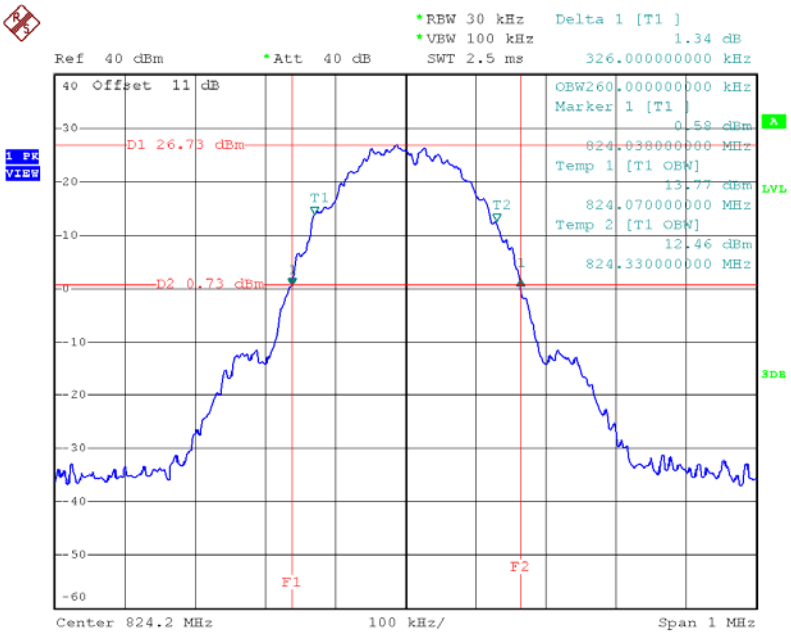
99% Occupied Bandwidth channel 251



Date: 27.APR.2015 12:08:12

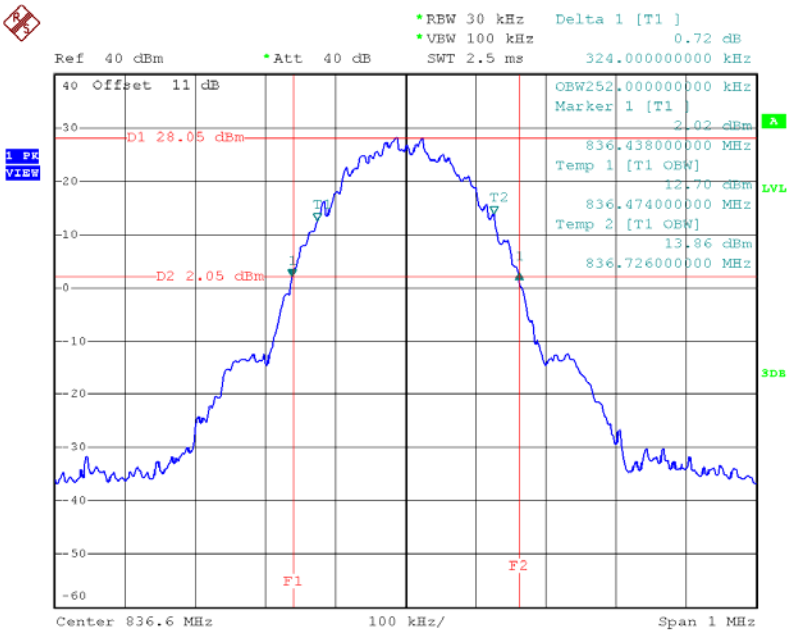
Test Mode : TX Mode Configuration EDGE				
Channel	**Frequency**	**99% OBW (MHz)**	**-26dBc Bandwidth(MHz)**	**Result**
128	824.20 MHz	0.260	0.326	**Complies**
190	836.60 MHz	0.252	0.324	**Complies**
251	848.80 MHz	0.256	0.320	**Complies**

99% Occupied Bandwidth channel 128



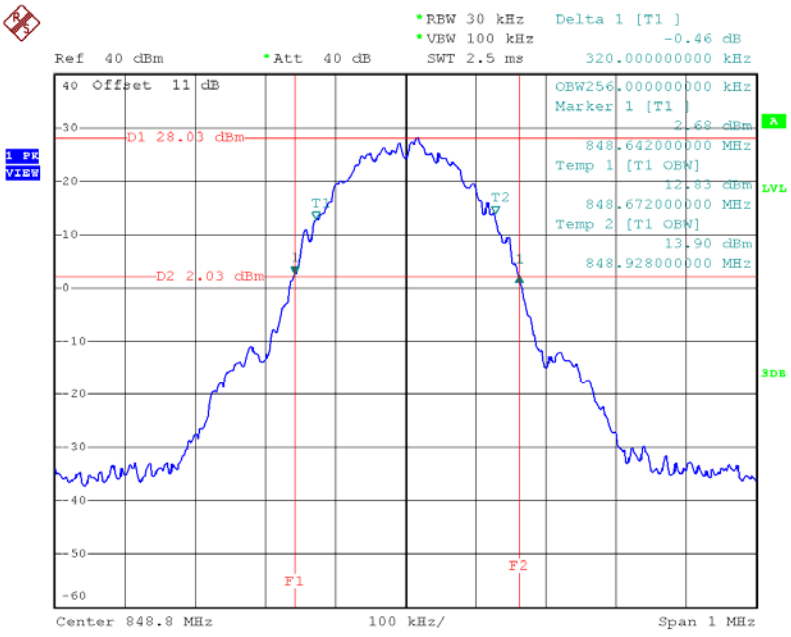
Date: 27.APR.2015 14:40:22

99% Occupied Bandwidth channel 190



Date: 27.APR.2015 14:45:13

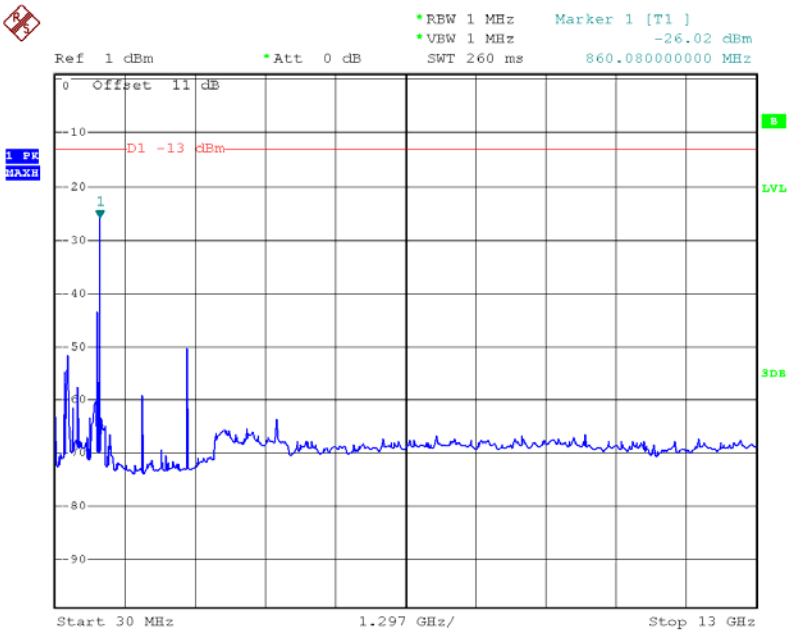
99% Occupied Bandwidth channel 251



Date: 27.APR.2015 14:46:13

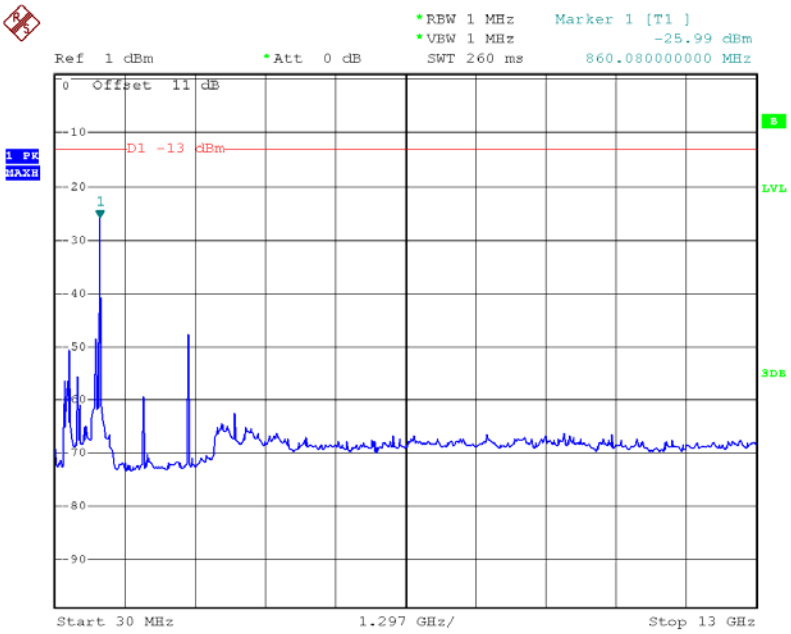
ATTACHMENT C - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Conducted Spurious of Configuration GSMchannel 128



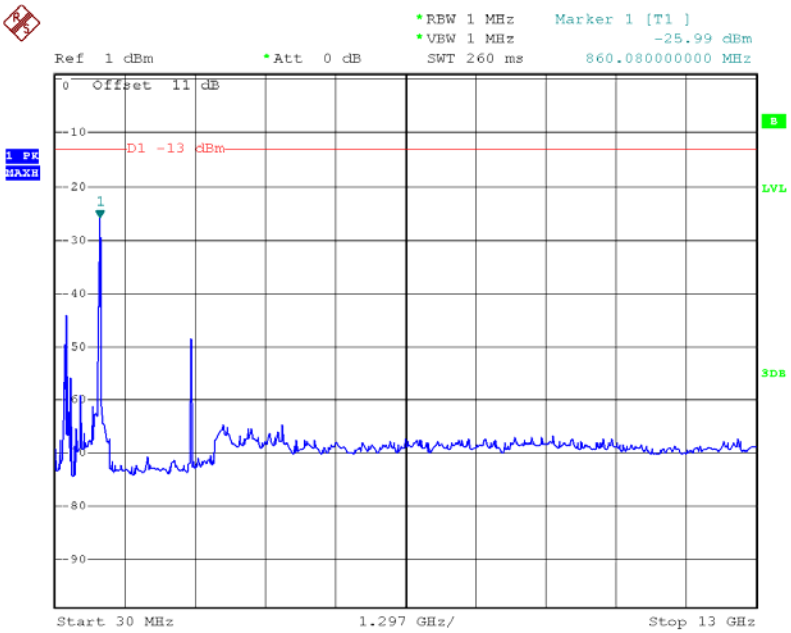
Date: 27.APR.2015 11:56:13

Conducted Spurious of Configuration GSMchannel 190



Date: 27.APR.2015 11:57:18

Conducted Spurious of Configuration GSMchannel 251

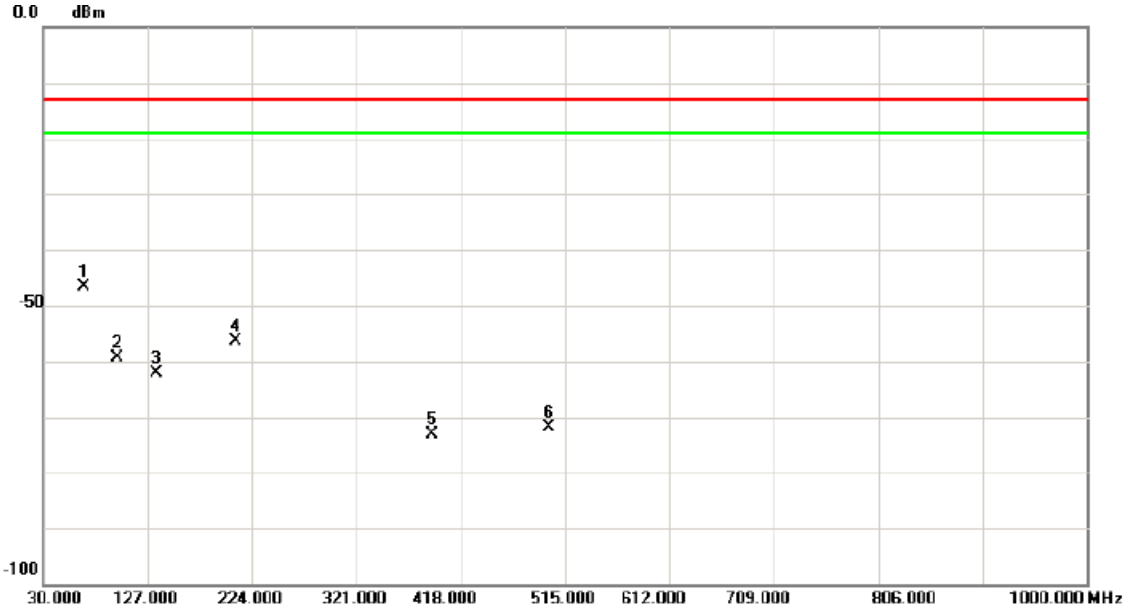


Date: 27.APR.2015 11:57:41

ATTACHMENTD - SPURIOUS RADIATED EMISSION

Test Mode:	TX CH190 GSM

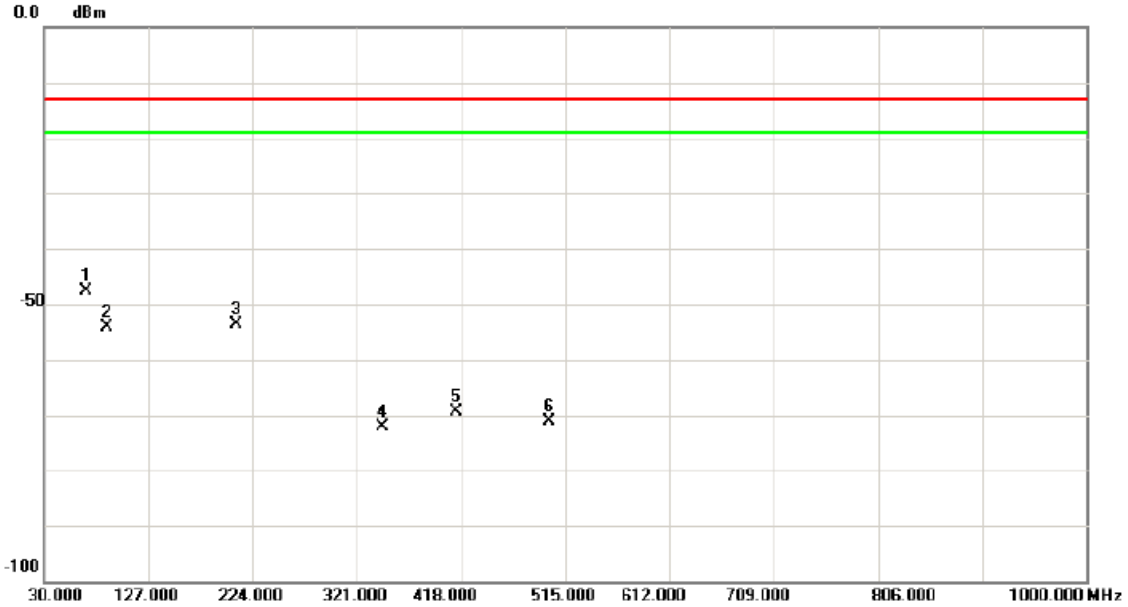
Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBm	dB	dBm	dBm	dB	Detector	Comment
1	*	67.8300	-47.12	0.40	-46.72	-13.00	-33.72	peak	
2		98.8700	-57.54	-1.87	-59.41	-13.00	-46.41	peak	
3		135.7300	-63.08	0.97	-62.11	-13.00	-49.11	peak	
4		209.4500	-54.01	-2.48	-56.49	-13.00	-43.49	peak	
5		390.8400	-77.22	3.98	-73.24	-13.00	-60.24	peak	
6		499.4800	-79.49	7.52	-71.97	-13.00	-58.97	peak	

Test Mode:	TX CH190 GSM

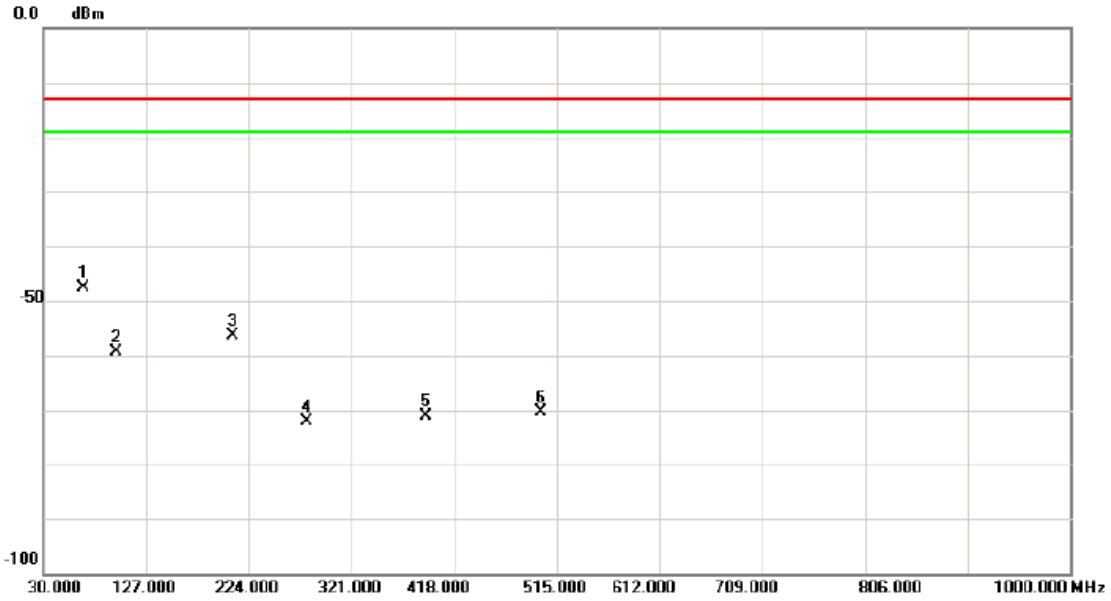
Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBm	dB	dBm	dBm	dB	Detector	Comment
1	*	68.8000	-44.43	-3.29	-47.72	-13.00	-34.72	peak	
2		88.2000	-47.11	-7.13	-54.24	-13.00	-41.24	peak	
3		209.4500	-51.56	-1.94	-53.50	-13.00	-40.50	peak	
4		345.2500	-74.93	2.84	-72.09	-13.00	-59.09	peak	
5		413.1500	-75.96	6.54	-69.42	-13.00	-56.42	peak	
6		499.4800	-79.16	8.02	-71.14	-13.00	-58.14	peak	

Test Mode:	TX CH190 EDGE

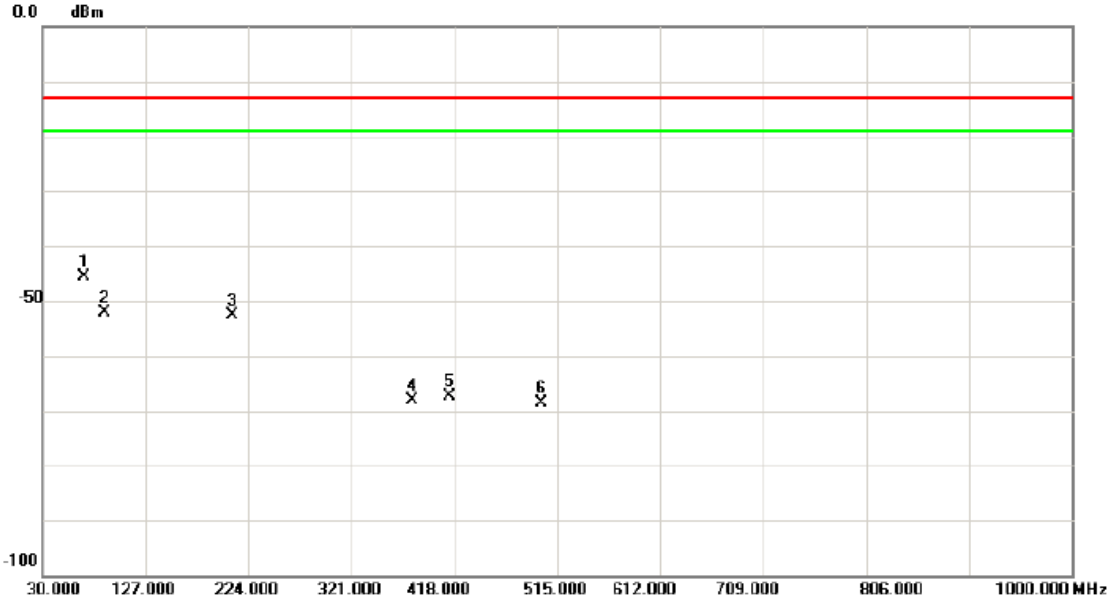
Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBm	dB	dBm	dBm	dB	Detector	Comment
1	*	67.8300	-48.12	0.40	-47.72	-13.00	-34.72	peak	
2		98.8700	-57.54	-1.87	-59.41	-13.00	-46.41	peak	
3		209.4500	-54.01	-2.48	-56.49	-13.00	-43.49	peak	
4		278.3200	-74.72	2.57	-72.15	-13.00	-59.15	peak	
5		390.8400	-75.22	3.98	-71.24	-13.00	-58.24	peak	
6		499.4800	-77.99	7.52	-70.47	-13.00	-57.47	peak	

Test Mode:	TX CH190 EDGE

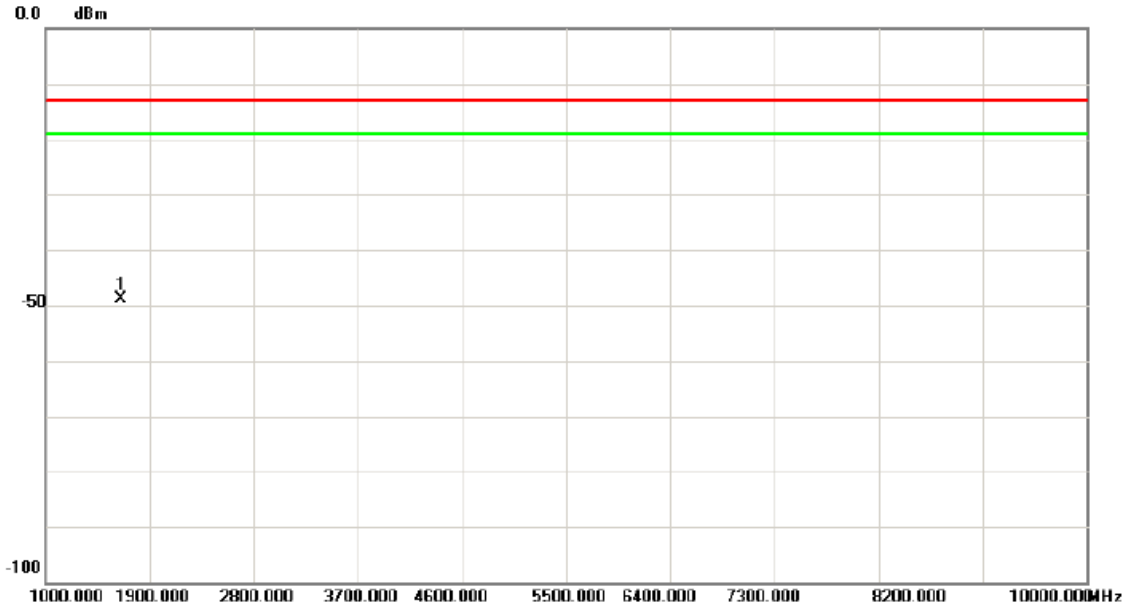
Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBm	dB	dBm	dBm	dB	Detector	Comment
1	*	68.8000	-42.43	-3.29	-45.72	-13.00	-32.72	peak	
2		88.2000	-45.11	-7.13	-52.24	-13.00	-39.24	peak	
3		209.4500	-50.56	-1.94	-52.50	-13.00	-39.50	peak	
4		378.2300	-73.93	5.89	-68.04	-13.00	-55.04	peak	
5		413.1500	-73.96	6.54	-67.42	-13.00	-54.42	peak	
6		499.4800	-76.66	8.02	-68.64	-13.00	-55.64	peak	

Test Mode:	TX CH128 GSM

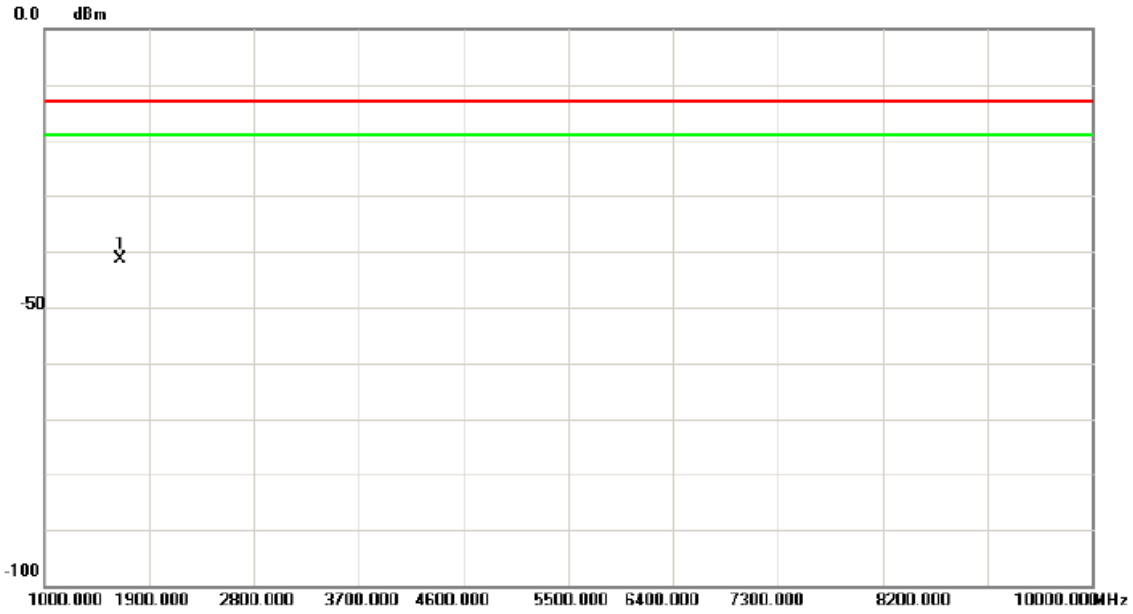
Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBm	dB	dBm	dBm	dB	Detector	Comment
1	*	1648.300	-39.95	-8.97	-48.92	-13.00	-35.92	peak	

Test Mode:	TX CH128 GSM

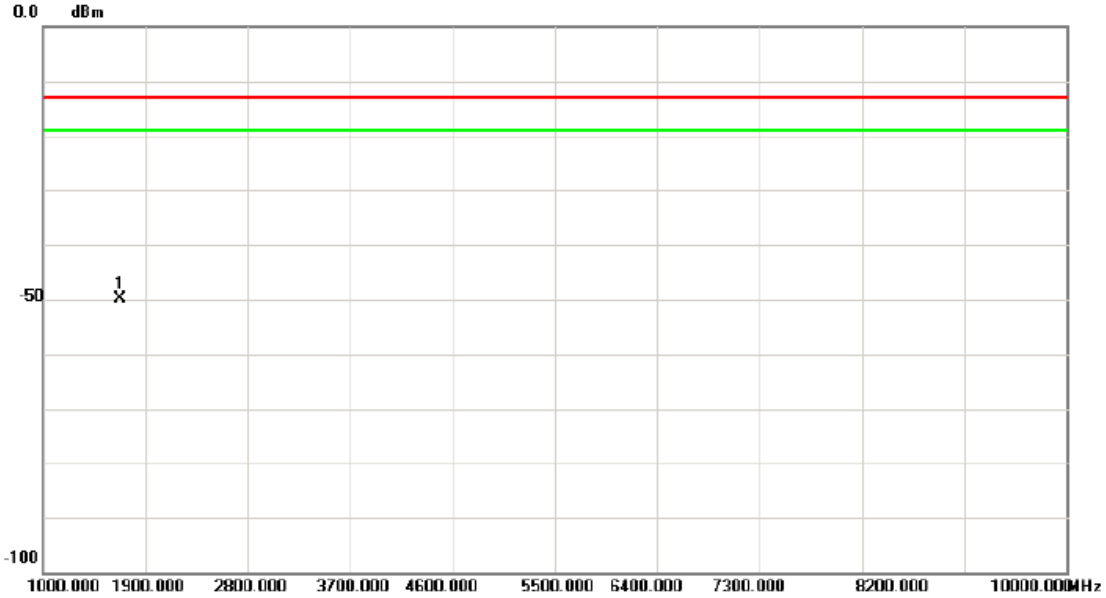
Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBm	dB	dBm	dBm	dB	Detector	Comment
1	*	1648.300	-33.44	-7.97	-41.41	-13.00	-28.41	peak	

Test Mode:	TX CH190 GSM

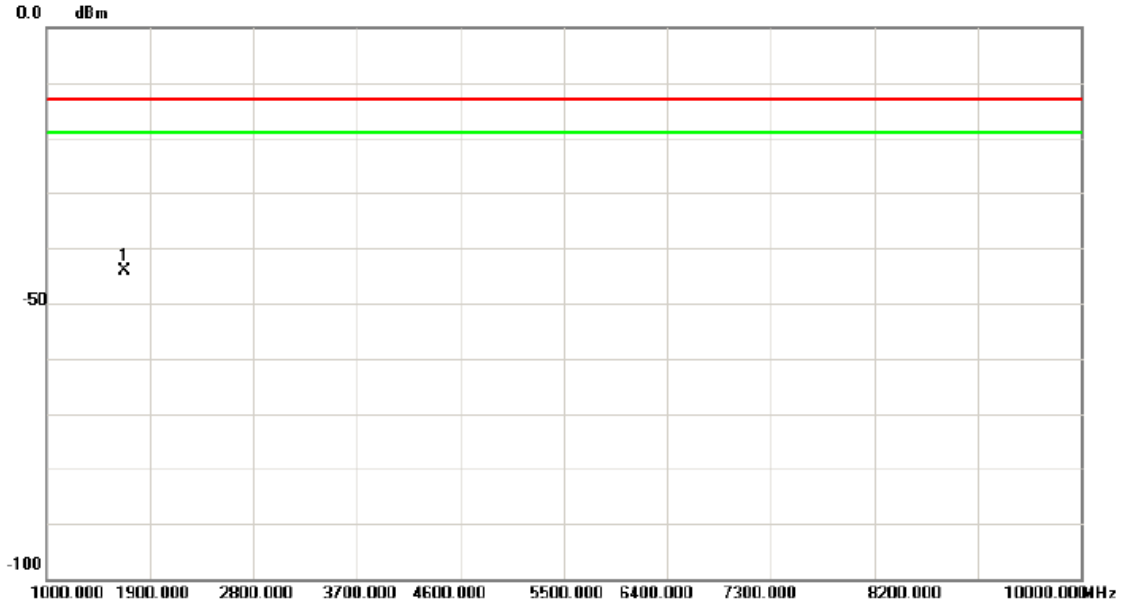
Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBm	dB	dBm	dBm	dB	Detector	Comment
1	*	1672.900	-41.08	-8.85	-49.93	-13.00	-36.93	peak	

Test Mode:	TX CH190 GSM

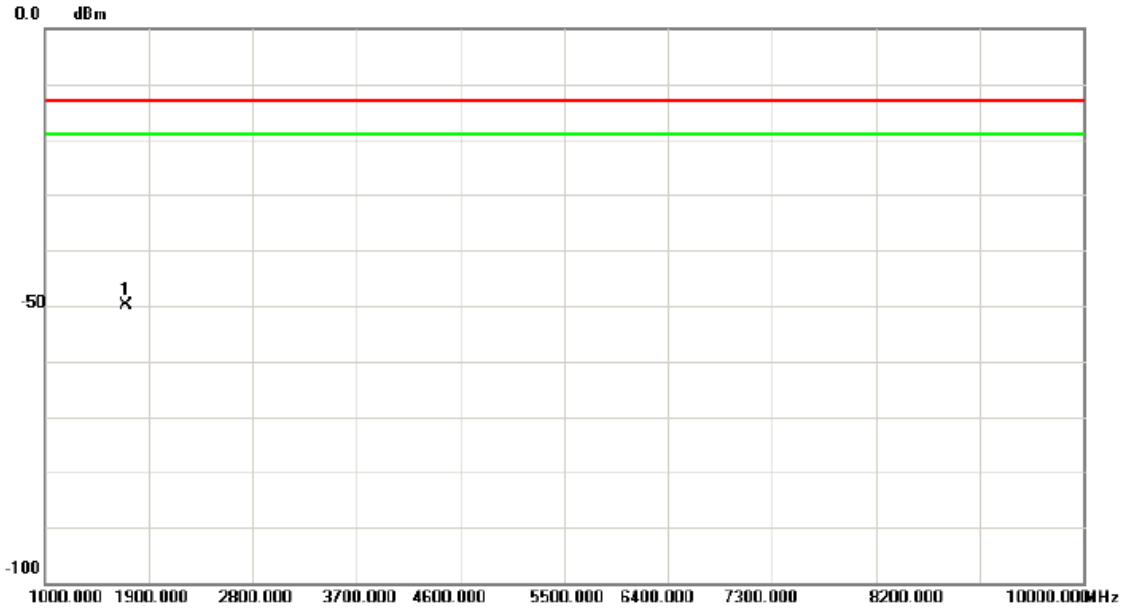
Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBm	dB	dBm	dBm	dB	Detector	Comment
1	*	1673.280	-36.33	-7.82	-44.15	-13.00	-31.15	peak	

Test Mode:	TX CH251 GSM

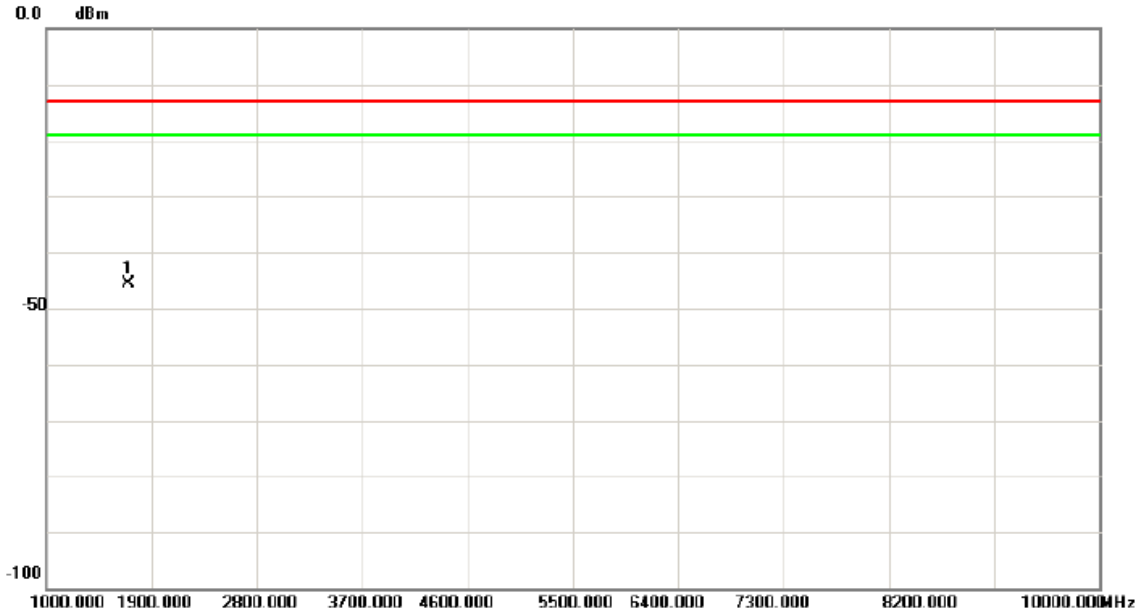
Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBm	dB	dBm	dBm	dB	Detector	Comment
1	*	1697.600	-41.27	-8.72	-49.99	-13.00	-36.99	peak	

Test Mode:	TX CH251 GSM

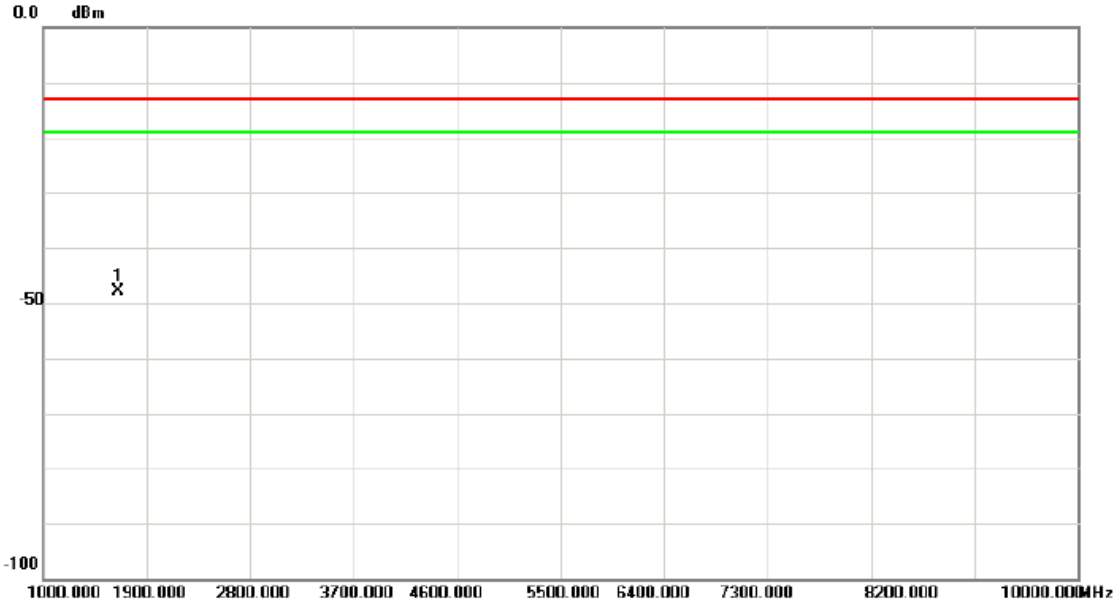
Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBm	dB	dBm	dBm	dB	Detector	Comment
1	*	1697.400	-37.87	-7.68	-45.55	-13.00	-32.55	peak	

Test Mode:	TX CH128 EDGE

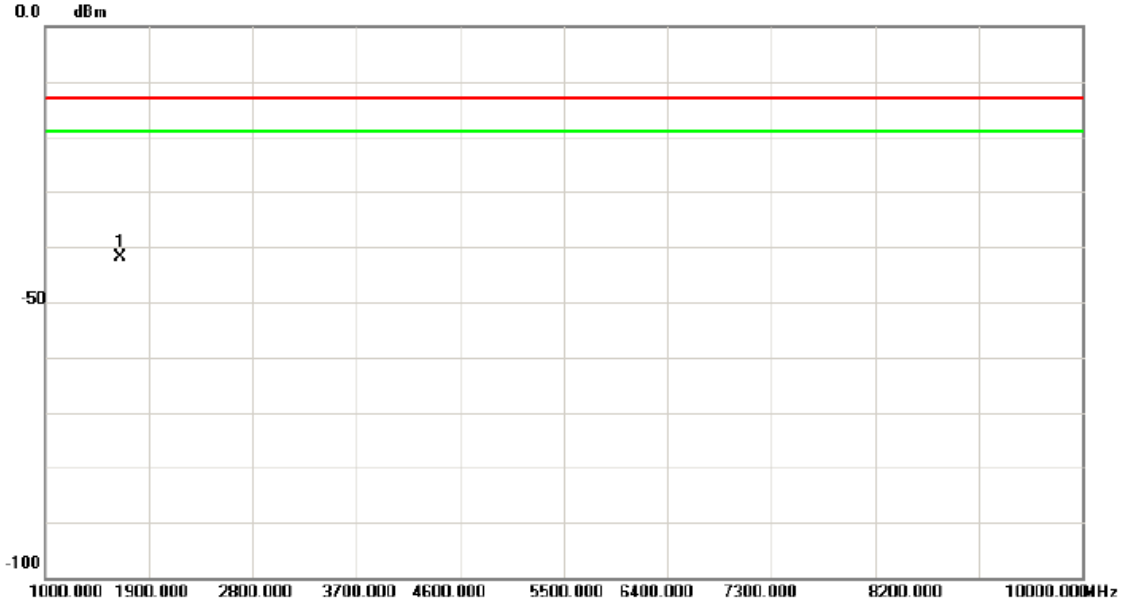
Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBm	dB	dBm	dBm	dB	Detector	Comment
1	*	1648.290	-38.96	-8.97	-47.93	-13.00	-34.93	peak	

Test Mode:	TX CH128 EDGE

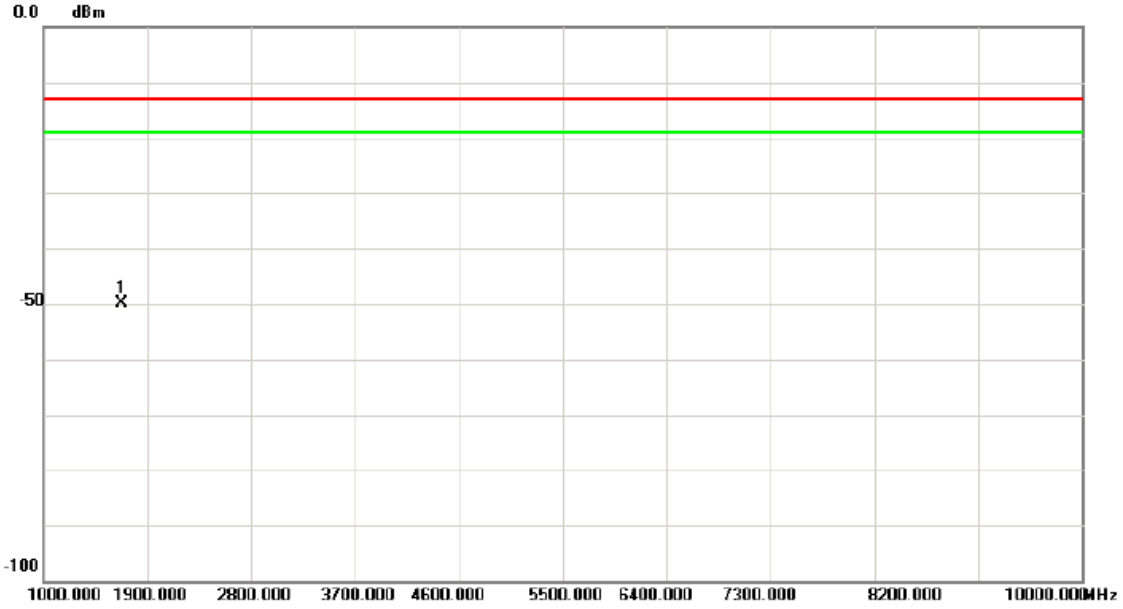
Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBm	dB	dBm	dBm	dB	Detector	Comment
1	*	1648.220	-33.86	-7.97	-41.83	-13.00	-28.83	peak	

Test Mode:	TX CH190 EDGE

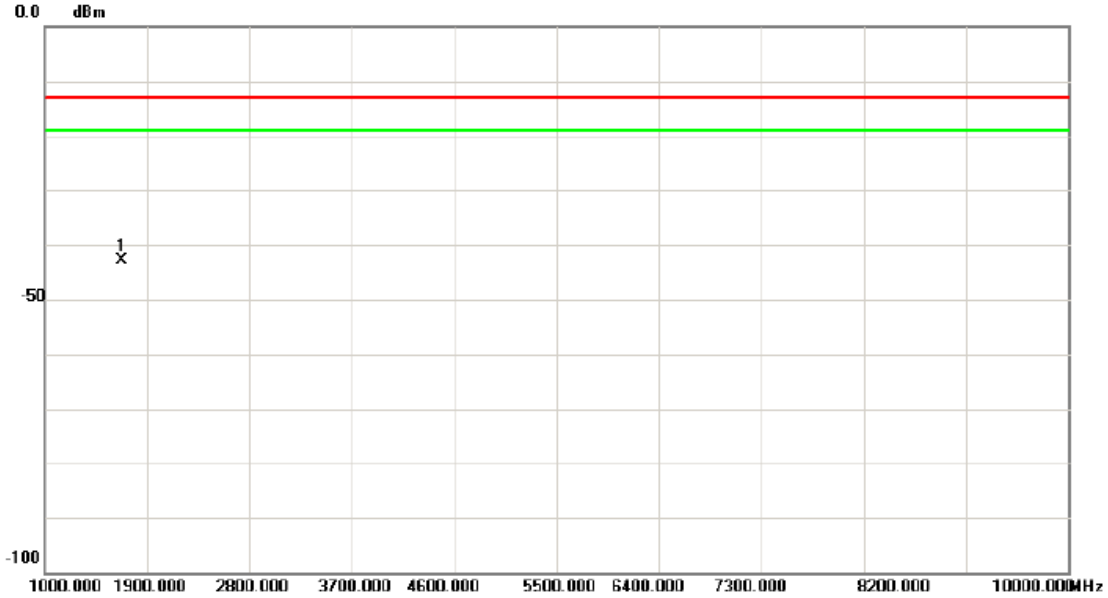
Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBm	dB	dBm	dBm	dB	Detector	Comment
1	*	1672.670	-40.97	-8.85	-49.82	-13.00	-36.82	peak	

Test Mode:	TX CH190 EDGE

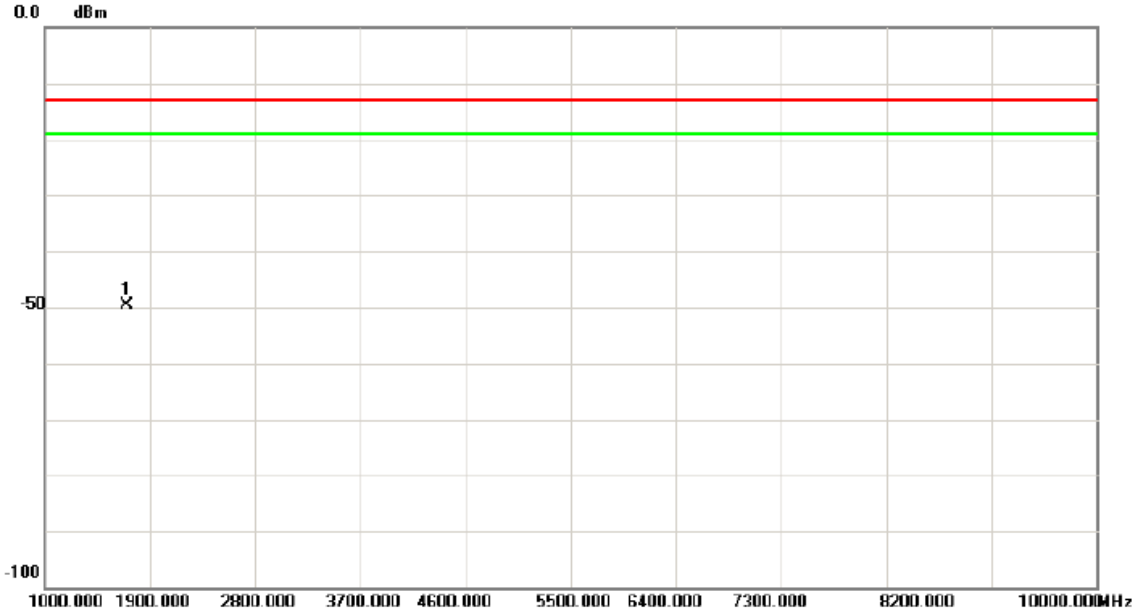
Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBm	dB	dBm	dBm	dB	Detector	Comment
1	*	1673.210	-35.01	-7.82	-42.83	-13.00	-29.83	peak	

Test Mode:	TX CH251 EDGE

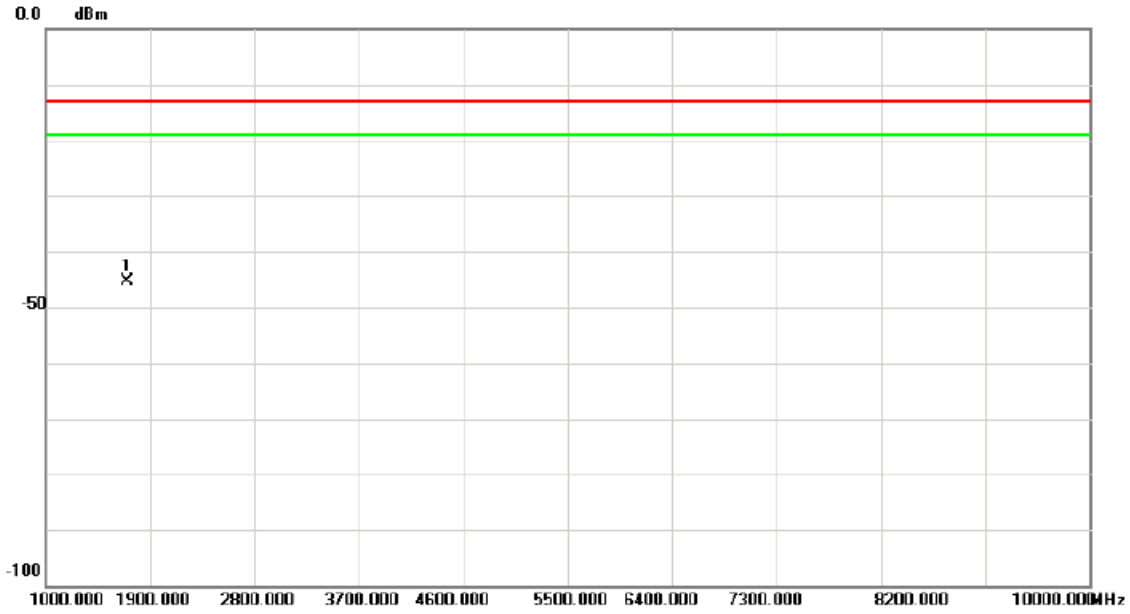
Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBm	dB	dBm	dBm	dB	Detector	Comment
1	*	1697.380	-40.85	-8.72	-49.57	-13.00	-36.57	peak	

Test Mode:	TX CH251 EDGE

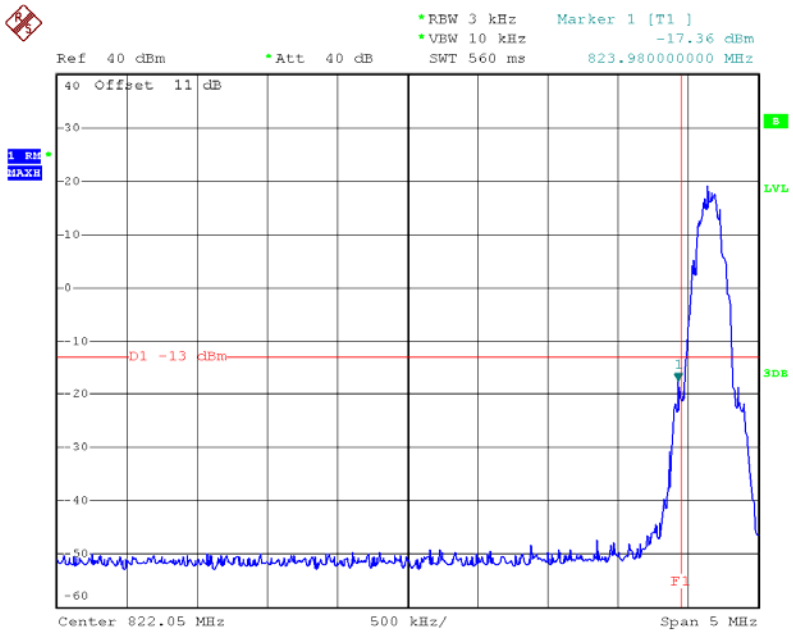
Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBm	dB	dBm	dBm	dB	Detector	Comment
1	*	1697.320	-37.58	-7.68	-45.26	-13.00	-32.26	peak	

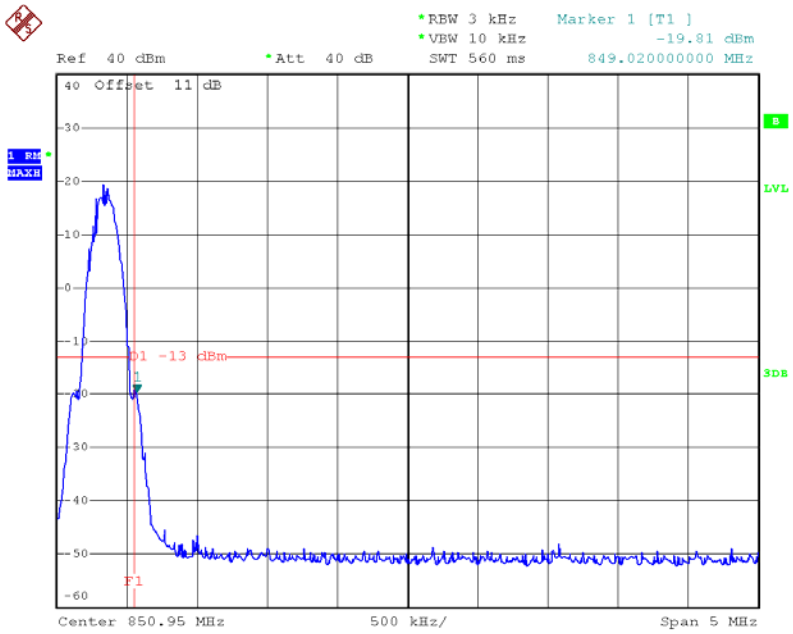
ATTACHMENTE - BAND EDGE

Band Edge on Configuration GSM / Channel 128-CONDUCTED MODE



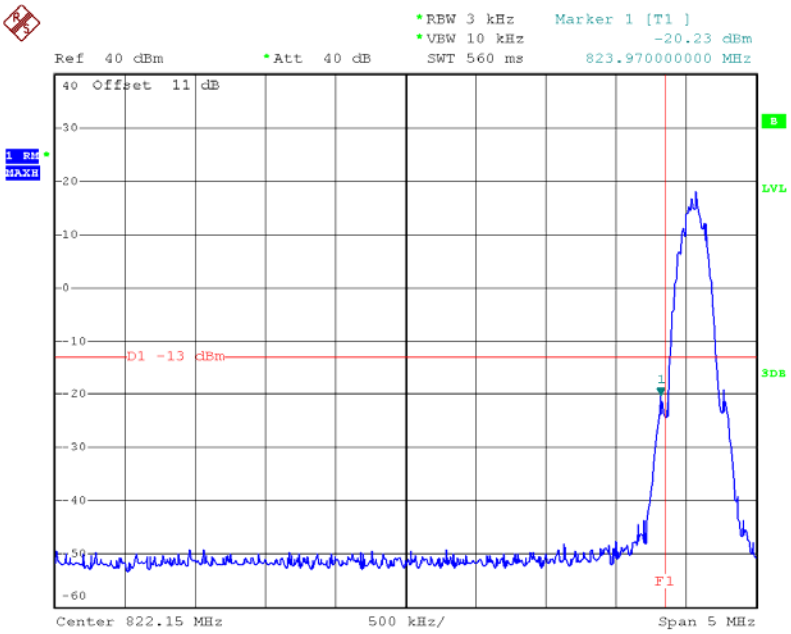
Date: 27.APR.2015 11:50:07

Band Edge on Configuration GSM / Channel 251-CONDUCTED MODE



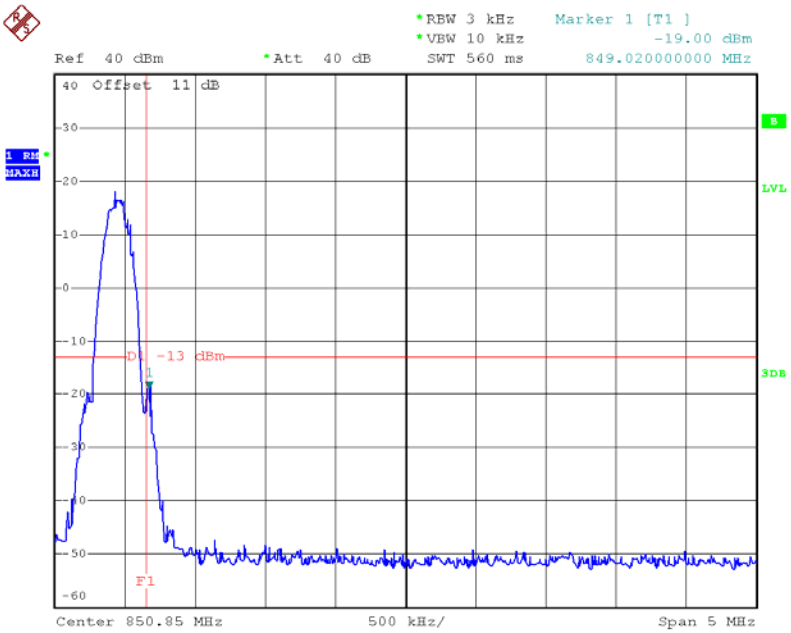
Date: 27.APR.2015 11:49:07

Band Edge on Configuration GPRS / Channel 128-CONDUCTED MODE



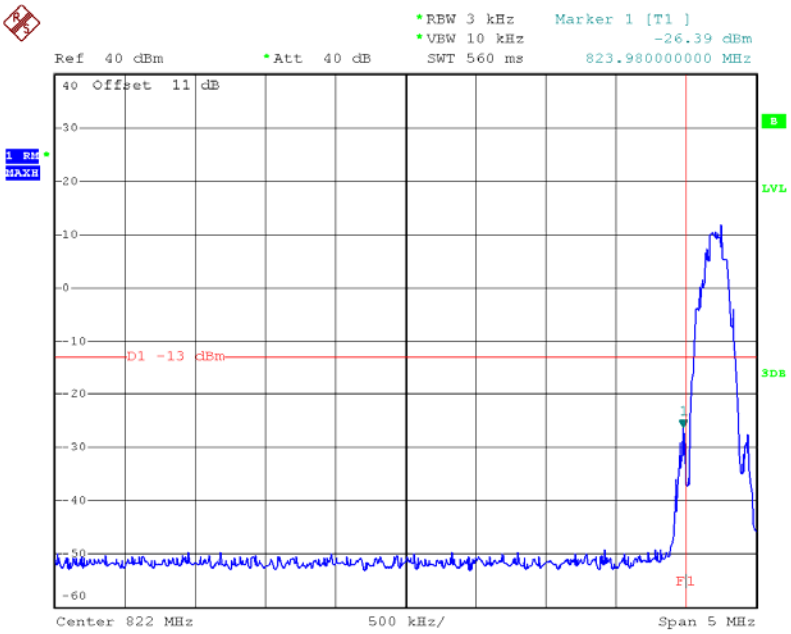
Date: 27.APR.2015 12:05:30

Band Edge on Configuration GPRS / Channel 251-CONDUCTED MODE



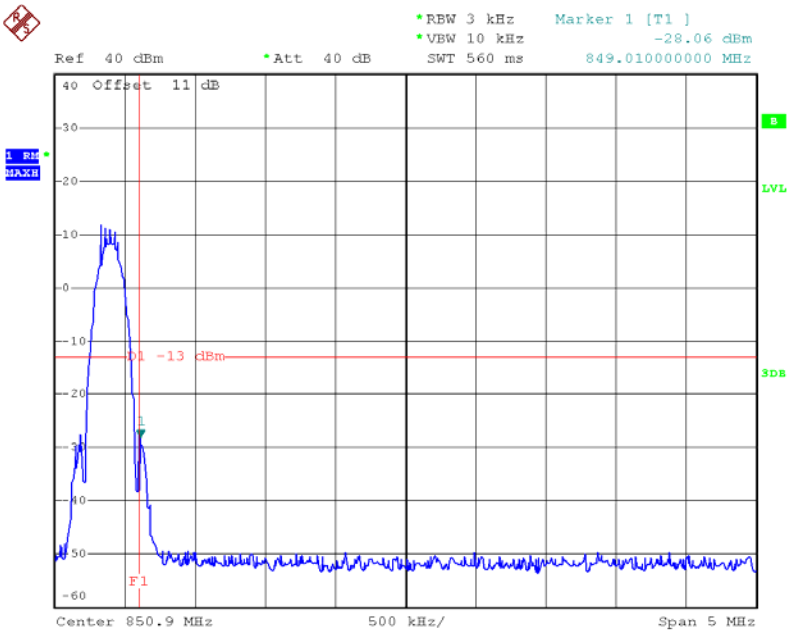
Date: 27.APR.2015 12:09:05

Band Edge on Configuration EDGE / Channel 128-CONDUCTED MODE



Date: 27.APR.2015 14:43:44

Band Edge on Configuration EDGE / Channel 251-CONDUCTED MODE



Date: 27.APR.2015 14:46:52

ATTACHMENTF - FREQUENCY STABILITY

Test Mode:	TX CH 128 GSM

Voltage vs. Frequency Stability

Voltage(Volts)	Frequency Error (Hz)	Frequency Error (ppm)	Limit(ppm)
3.5	10	0.013346275	0.1
3.6	14	0.01091968	0.1
3.7	10	0.014559573	0.1
3.8	13	0.009706382	0.1
3.9	11	0.018199466	0.1
4.0	12	0.015772871	0.1
4.1	15	0.012132977	0.1
4.2	16	0.014559573	0.1
Max. Deviation (ppm)	**16**	**0.018199466**	**0.1**

Temperature vs. Frequency Stability

Temperature(℃)	Frequency Error (Hz)	Frequency Error (ppm)	Limit(ppm)
45	17	0.019412764	0.1
30	15	0.016986168	0.1
20	18	0.015772871	0.1
10	19	0.012132977	0.1
0	14	0.013346275	0.1
Max. Deviation (ppm)	**19**	**0.019412764**	**0.1**

Test Mode:	TX CH 128 EDGE

Voltage vs. Frequency Stability

Voltage(Volts)	Frequency Error (Hz)	Frequency Error (ppm)	Limit(ppm)
3.5	10	0.01091968	0.1
3.6	12	0.012132977	0.1
3.7	11	0.014559573	0.1
3.8	13	0.013346275	0.1
3.9	12	0.009706382	0.1
4.0	10	0.01091968	0.1
4.1	12	0.013346275	0.1
4.2	13	0.012132977	0.1
Max. Deviation (ppm)	**13**	**0.014559573**	**0.1**

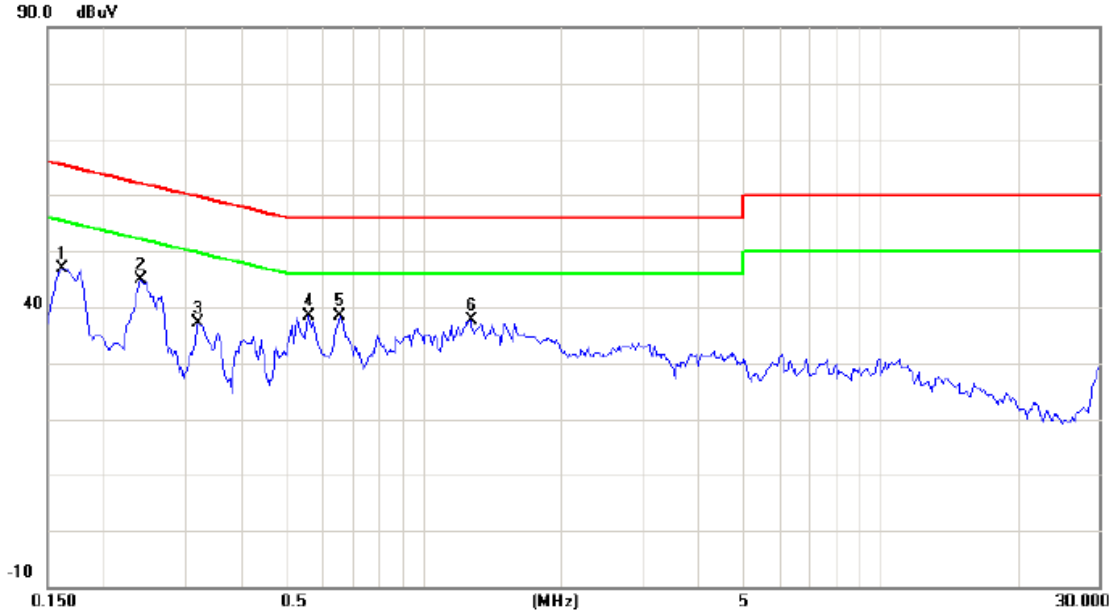
Temperature vs. Frequency Stability

Temperature(℃)	Frequency Error (Hz)	Frequency Error (ppm)	Limit(ppm)
45	15	0.014559573	0.1
30	16	0.018199466	0.1
20	14	0.014559573	0.1
10	15	0.018199466	0.1
0	13	0.015772871	0.1
Max. Deviation (ppm)	**16**	**0.018199466**	**0.1**

ATTACHMENTG -CONDUCTED EMISSION

Test Mode:	TX Mode

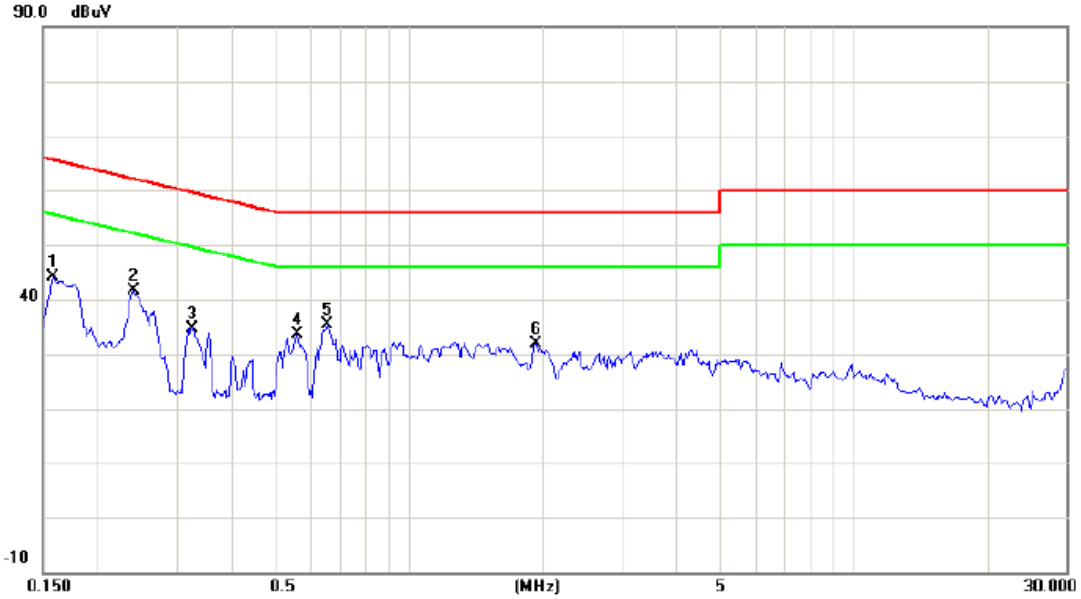
Line



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1617	37.12	9.66	46.78	65.38	-18.60	peak	
2	*	0.2398	35.24	9.71	44.95	62.10	-17.15	peak	
3		0.3215	27.40	9.75	37.15	59.67	-22.52	peak	
4		0.5601	28.62	9.82	38.44	56.00	-17.56	peak	
5		0.6540	28.52	9.85	38.37	56.00	-17.63	peak	
6		1.2670	27.72	9.92	37.64	56.00	-18.36	peak	

Test Mode:	TX Mode

Neutral



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1577	34.46	9.57	44.03	65.58	-21.55	peak	
2	*	0.2398	32.10	9.60	41.70	62.10	-20.40	peak	
3		0.3256	25.14	9.61	34.75	59.56	-24.81	peak	
4		0.5601	24.02	9.65	33.67	56.00	-22.33	peak	
5		0.6542	25.85	9.65	35.50	56.00	-20.50	peak	
6		1.9273	21.96	9.85	31.81	56.00	-24.19	peak	