Nemko Korea Co., Ltd.

155 & 159, Osan-Ro, Mohyeon-Eup, Cheoin-Gu, Yongin-Si, Gyeonggi-Do 16885 KOREA, REPUBLIC OF
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FCC and IC EVALUATION REPORT FOR CERTIFICATION

Applicant :

AJAX SYSTEMS CYPRUS HOLDINGS LTD
Ifigeneias, 17, Strovolos, 2007, Nicosia, Cyprus
Attn. : IRYNA KHIMYCH

Dates of Issue : August 12, 2021
Test Report No. : NK-21-R-231
Test Site : Nemko Korea Co., Ltd.

FCC ID	**2AX5VHUB2-NA**
IC	**26860-HUB2NA1**
Brand Name	**Ajax**
Contact Person	**AJAX SYSTEMS CYPRUS HOLDINGS LTD** **Ifigeneias, 17, Strovolos, 2007, Nicosia, Cyprus** **IRYNA KHIMYCH** **Telephone No. : 380502279091**

Applied Standard:	FCC 47 CFR Part 2, Part 22 subpart H, Part 24 subpart E IC RSS-132 Issue 3, RSS-133 Issue 6
FCC Classification:	PCS Licensed Transmitter (PCB)
EUT Type:	Security Control Panel

The device bearing the brand name and model specified above has been shown to comply with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.26-2015. The client should not use it to claim product endorsement by TAF or any government agencies. The test results in the report only apply to the tested sample.

I attest to the accuracy of data and all measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Aug. 12. 2021

Tested By : Yonghwan Kim
Engineer

Aug. 12. 2021

Reviewed By : Seungyong Shin
Technical Manager

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1. SCOPE

Measurement and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission under FCC part 2, part 22 subpart H, part 24 subpart E and IC RSS-132 Issue 3, IC RSS-133 Issue 6 .

Responsible Party :	AJAX SYSTEMS CYPRUS HOLDINGS LTD Ifigeneias, 17, Strovolos, 2007, Nicosia, Cyprus
Contact Person :	IRYNA KHIMYCH
Manufacturer :	AJAX SYSTEMS MANUFACTURING LIMITED LIABILITY COMPANY Sklyarenka, 5, Kyiv, 04073 Ukraine

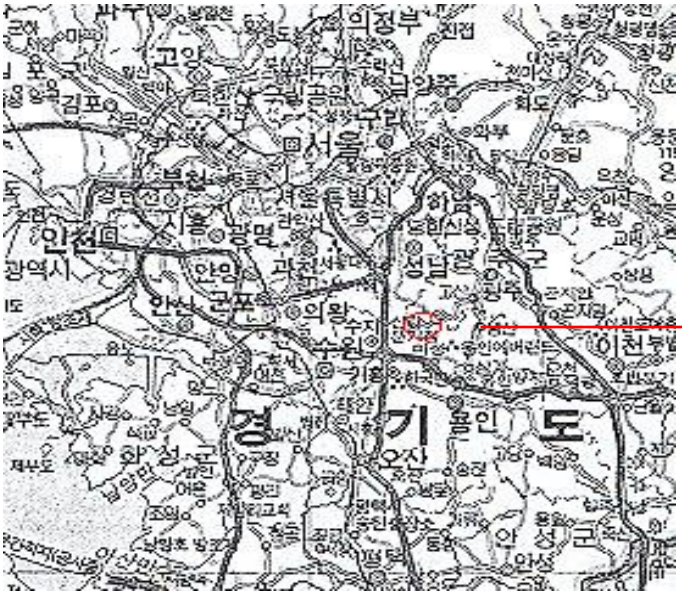
- FCC ID: 2AX5VHUB2-NA
- IC: 26860-HUB2NA1
- Model: Ajax Hub 2 (9NA)
- HVIN: Ajax Hub 2 (9NA)
- Brand Name: Ajax
- EUT Type: Security Control Panel
- Classification: PCS Licensed Transmitter (PCB)
- Applied Standard: FCC 47 CFR Part 2, Part 22 subpart H, Part 24 subpart E
  IC RSS-132 Issue 3, RSS-133 Issue 6
- Test Procedure(s): ANSI C63.26-2015
  KDB 971168 D01 Power Meas License Digital Systems v03r01
- Dates of Test: July 14, 2021 ~ August 3, 2021
- Place of Test: Nemko Korea Co., Ltd.

2. INTRODUCTION

2.1 Test facility

The measurement procedure described in American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services (ANSI C63.26-2015) was used in determining radiated and conducted emissions emanating from **AJAX SYSTEMS CYPRUS HOLDINGS LTD FCC ID : 2AX5VHUB2-NA** and **IC : 26860-HUB2NA1.**

These measurement tests were conducted at ***Nemko Korea Co., Ltd. EMC Laboratory*** .
The site address 155 & 159, Osan-Ro, Mohyeon-Eup, Cheoin-Gu, Yongin-Si, Gyeonggi-Do 16885 KOREA, REPULIC OF.
The area of Nemko Korea Corporation Ltd. EMC Test Site is located in a mountain area at 80 km (48 miles) southeast and Incheon International Airport (Incheon Airport), 30 km (18miles) south-southeast from central Seoul.
It is located in the valley surrounded by mountains in all directions where ambient radio signal conditions are quiet and a favorable area to measure the radio frequency interference on open field test site for the computing and ISM devices manufactures.
The detailed description of the measurement facility was found to be in compliance with the requirements of ANSI C63.26-2015 according to §2.948.



Nemko Korea Co., Ltd.
EMC Lab.
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Fig. 1. The map above shows the Seoul in Korea vicinity area.
The map also shows Nemko Korea Corporation Ltd. EMC Lab. and Incheon Airport.

2.2 Accreditation and listing

Accreditation type		Accreditation number
	CAB Accreditation for DOC	Designation No. KR0026
	KOLAS Accredited Lab. (Korea Laboratory Accreditation Scheme)	Registration No. KT155
	Canada IC Registered site	Site No. 2040E
	VCCI registration site(RE/CE/Telecom CE)	Member No. 2118
	EMC CBTL	-
	KCC(RRL)Designated Lab.	Registration No. KR0026

3. TEST CONDITIONS & EUT INFORMATION

3.1 Operation During Test

The EUT supports the GSM 850/1900 mode.
The WIDEBAND RADIO COMMUNICATION TESTER was used to control the EUT to transmit the wanted TX channel.
The operating voltage of EUT was 120 Vac supplied.
The EUT was tested at the lowest, middle and the highest channels with the maximum output power in accordance with the manufacturer's specifications. The worst data were recorded in the report.

3.1.1 Table of test power setting

Frequency	Mode	Power setting Level
824.2 MHz ~ 848.8 MHz	GPRS	Max
1 850.2 MHz ~ 1 909.8 MHz	GPRS	Max

3.1.2 Table of test channels

Frequency band	Mode	Test Channel (CH)	Frequency (MHz)
GSM 850	GPRS	128	824.2
		190	836.6
		251	848.8
GSM 1900	GPRS	512	1 850.2
		661	1 880.0
		810	1 909.8

3.1.3 Antenna information

Frequency band	Mode	Antenna TX mode
GSM 850	GPRS	■ 1TX, □ 2TX
GSM 1900	GPRS	■ 1TX, □ 2TX

3.1.4 Additional Information Related to Testing

The cable and attenuator loss from 30MHz to 20GHz was reflected in spectrum analyzer with correction factor for all conducted testing.

3.1.5 Table of test modes

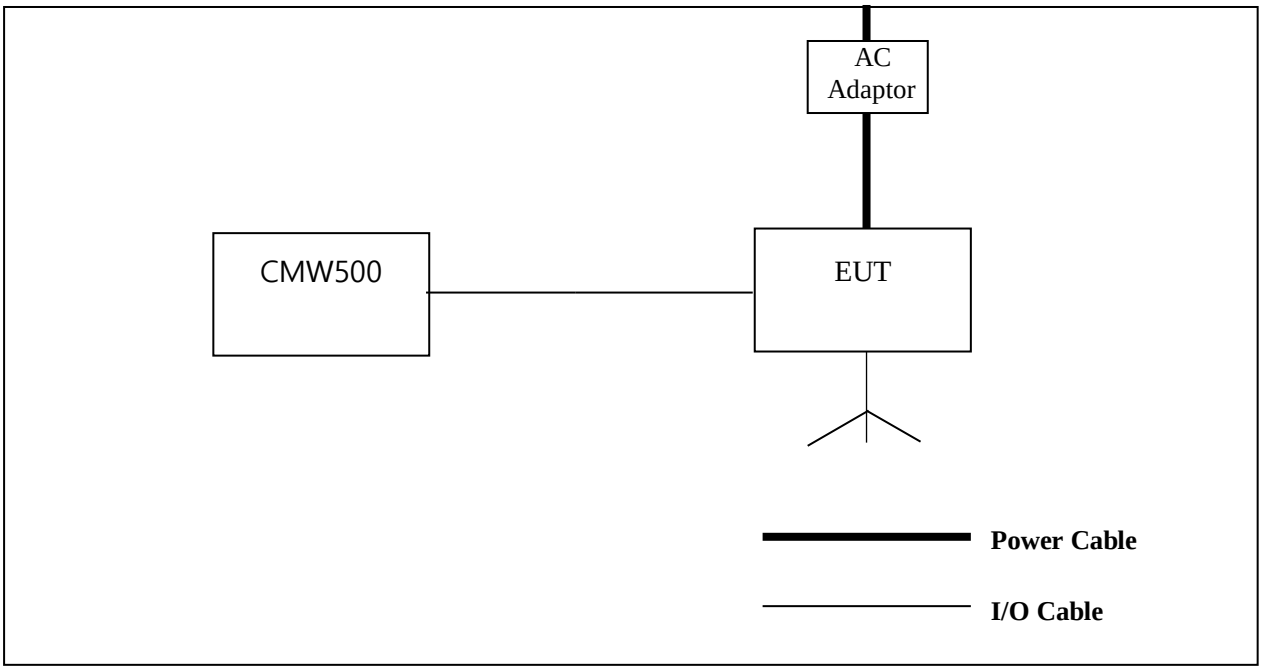
GSM 850 - Part 22 subpart H, RSS-132 Issue 3				
Test Items	Mode	Modulation	Test Channel (CH)	Remark
RF Power Output, Effective Radiated Power, Equivalent Isotropically Radiated Power	GPRS	GMSK	128/190/251	Conducted
Peak-to-Average Power Ratio	GPRS	GMSK	128/190/251	Conducted
Occupied Bandwidth	GPRS	GMSK	128/190/251	Conducted
Band Edge at Antenna Terminals	GPRS	GMSK	128//251	Conducted
Spurious Emissions at Antenna Terminals	GPRS	GMSK	128/190/251	Conducted
Frequency Stability	GPRS	GMSK	128/190/251	Conducted
Effective Radiated Power, Equivalent Isotropically Radiated Power	GPRS	GMSK	128/190/251	Radiated
Field Strength of Spurious Radiation	GPRS	GMSK	128/190/251	Radiated

GSM 1900 - Part 24 subpart E, RSS-133 Issue 6				
Test Items	Mode	Modulation	Test Channel (CH)	Remark
RF Power Output, Equivalent Isotropically Radiated Power	GPRS	GMSK	512/661/810	Conducted
Peak-to-Average Power Ratio	GPRS	GMSK	512/661/810	Conducted
Occupied Bandwidth	GPRS	GMSK	512/661/810	Conducted
Band Edge at Antenna Terminals	GPRS	GMSK	512/810	Conducted
Spurious Emissions at Antenna Terminals	GPRS	GMSK	512/661/810	Conducted
Frequency Stability	GPRS	GMSK	512/661/810	Conducted
Equivalent Isotropically Radiated Power	GPRS	GMSK	512/661/810	Radiated
Field Strength of Spurious Radiation	GPRS	GMSK	512/661/810	Radiated

3.2 Support Equipment

EUT	AJAX SYSTEMS CYPRUS HOLDINGS LTD Model : Ajax Hub 2 (9NA)	S/N: N/A
Laptop Computer	N/A	S/N: N/A
AC/DC Adapter	N/A	S/N: N/A

3.3 Setup Drawing



3.4 EUT Information

The EUT is the **AJAX SYSTEMS CYPRUS HOLDINGS LTD Security Control Panel FCC ID: 2AX5VHUB2-NA, IC: 26860-HUB2NA1.**

Specifications:

EUT Type	Security Control Panel
Model Name	Ajax Hub 2 (9NA)
Brand Name	Ajax
Frequency of Operation	For GSM 850 Band 824.2 MHz ~ 848.8 MHz For GSM 1900 Band 1 850.2 MHz ~ 1 909.8 MHz
Output Power (Conducted)	For GSM 850 Band 18.47 dBm For GSM 1900 Band 14.66 dBm
FCC Classification	PCS Licensed Transmitter (PCB)
Number of Channels	For GSM 850 Band 124 CH For GSM 1900 Band 299 CH
Modulations	GMSK
Antenna Gain (peak)	0 dBi
Antenna Setup	1TX / 1RX
EUT Rated Voltage	a.c. 110-240 V, 50/60 Hz
EUT Test Voltage	a.c. 120 V, 60 Hz
Temperature Range	-10 ℃ ~ +40 ℃
Size (W x H x D)	About 165 mm x 25 mm x 165 mm
Weight	About 362 g
HVIN (Hardware Version Number)	Ajax Hub 2 (9NA)
FVIN (Firmware Version Identification Number)	N/A
Remarks	-

4. SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specification:

GSM 850 - Part 22 subpart H, RSS-132 Issue 3				
Name of Test	FCC Paragraph No.	IC Paragraph No.	Result	Remark
RF Power Output, Effective Radiated Power, Equivalent Isotropically Radiated Power	22.913(a)	RSS-132 Issue 3 5.4	Complies	
Peak-to-Average Power Ratio	22.913(d)	RSS-132 Issue 3 5.4	Complies	
Occupied Bandwidth	2.1049(h)	RSS-Gen Issue 5 6.7	Complies	
Band Edge at Antenna Terminals	22.917(a)	RSS-132 Issue 3 5.5	Complies	
Spurious Emissions at Antenna Terminals	22.917(a)	RSS-132 Issue 3 5.5	Complies	
Frequency Stability	22.355	RSS-132 Issue 3 5.3	Complies	
Effective Radiated Power Equivalent Isotropically Radiated Power	22.913(a)	RSS-132 Issue 3 5.4	Complies	
Field Strength of Spurious Radiation	22.917(a)	RSS-132 Issue 3 5.5	Complies	

GSM 1900 - Part 24 subpart E, RSS-133 Issue 6				
Name of Test	FCC Paragraph No.	IC Paragraph No.	Result	Remark
RF Power Output, Equivalent Isotropically Radiated Power	24.232(c)	RSS-133 Issue 6 6.4	Complies	
Peak-to-Average Power Ratio	24.232(d)	RSS-133 Issue 6 6.4	Complies	
Occupied Bandwidth	2.1049(h)	RSS-Gen Issue 5 6.7	Complies	
Band Edge at Antenna Terminals	24.238(a)	RSS-133 Issue 6 6.5	Complies	
Spurious Emissions at Antenna Terminals	24.238(a)	RSS-133 Issue 6 6.5	Complies	
Frequency Stability	24.235	RSS-133 Issue 6 6.3	Complies	
Equivalent Isotropically Radiated Power	24.232(c)	RSS-133 Issue 6 6.4	Complies	
Field Strength of Spurious Radiation	24.238(a)	RSS-133 Issue 6 6.5	Complies	

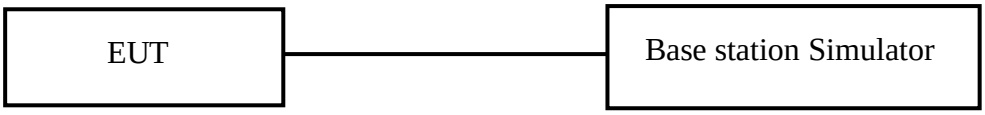
5. RECOMMENDATION/CONCLUSION

The data collected shows that the **AJAX SYSTEMS CYPRUS HOLDINGS LTD Security Control Panel FCC ID: 2AX5VHUB2-NA, IC: 26860-HUB2NA1** is in compliance with Part 2, Part 22 subpart H, Part 24 subpart E of the FCC Rule and RSS-132 Issue 3, RSS-133 Issue 6 of the IC Specification.

6. DESCRIPTION OF TESTS

6.1 RF Power Output, Effective Radiated Power, Equivalent Isotropically Radiated Power

Test Setup

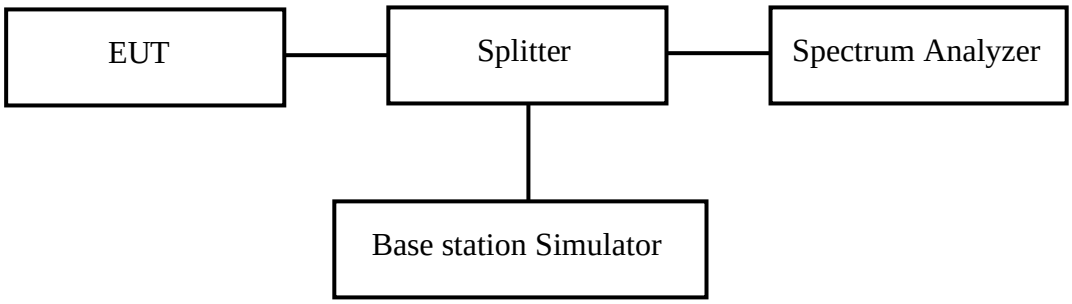


Test Procedure

EUTs Maximum Conducted Output Power is measured at low, middle, high channels with a Base station simulator connected to the antenna terminal while the EUTs operating at its maximum power control level.

6.2 Peak-to-Average Power Ratio

Test Setup



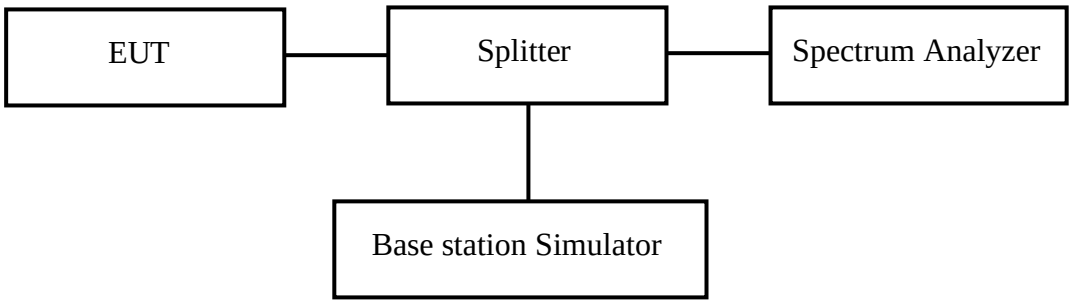
Test Procedure

EUTs Maximum Conducted Output Power is measured at low, middle, high channels with a spectrum analyzer connected to the antenna terminal while the EUTs operating at its maximum power control level.

Measure the total peak power and record as PPk. And measure the total average power and record as PAvg. Both the peak and average power levels must be expressed in the same logarithmic units (e.g., dBm). Determine the PAPR from:
PAPR (dB) = PPk (dBm) - PAvg (dBm).

6.3 Occupied Bandwidth

Test Setup

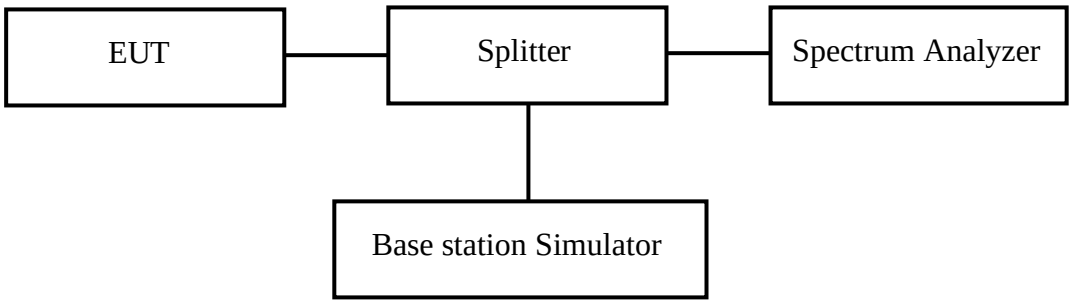


Test Procedure

EUTs Occupied Bandwidth is measured at low, middle, high channels with a spectrum analyzer connected to the antenna terminal while the EUTs operating at its maximum power control level.
The spectrum analyzer setting is as follows.
RBW = 3 kHz
VBW > 3 x RBW
Detector = Peak
Trace mode = max hold
Sweep = auto couple
The bandwidth measurement function on the spectrum analyzer is used to measure the 99% and 26 dB bandwidth.

6.4 Conducted Spurious Emissions

Test Setup



Test Procedure

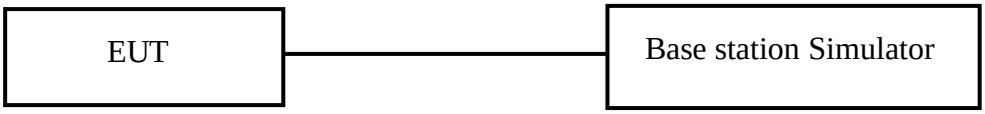
EUTs Conducted spurious emissions are measured at low, middle, high channels with a spectrum analyzer connected to the antenna terminal while the EUTs operating at its maximum power control level. The spectrum analyzer setting is as follows.

1) Band Edge at Antenna Terminals
Set the center frequency and span to encompass frequency range to be measured.
RBW = 3 kHz
VBW ≥ 3 x RBW
Detector = average
Sweep time = auto couple
Trace mode = average
Allow trace to fully stabilize.
Use the peak marker function to determine the maximum amplitude level.

2) Spurious Emissions at Antenna Terminals
Set the center frequency and span to encompass frequency range to be measured.
RBW = 100 kHz (Below 1 GHz) / 1 MHz (Above 1GHz)
VBW ≥ 3 x RBW
Detector = average
Sweep time = auto couple
Trace mode = average
Allow trace to fully stabilize.
Use the peak marker function to determine the maximum amplitude level.

6.5 Frequency Stability

Test Setup



Test Procedure

EUTs Frequency Stability is measured at low, middle, high channels with a Base station simulator connected to the antenna terminal.

The frequency stability shall be measured temperature was varied from -30°C to +50°C in 10°C step size and primary supply voltage from 85 to 115 percent of the nominal value.

6.6 Radiated Emissions

The measurement was performed at the test site that is specified in accordance with ANSI C63.26-2015.
The spurious emission was scanned from 9 kHz to 30 MHz using Loop Antenna(Rohde&Schwarz, HFH2-Z2) and 30 to 1000 MHz using Trilog broadband test antenna(Schwarzbeck, VULB 9163). Above 1 GHz, Horn antenna (Schwarzbeck BBHA 9120D: up to 18 GHz, Q-par Angus QSH20S20 : 18 to 20 GHz) was used.
For emissions testing at below 1GHz, The test equipment was placed on turntable with 0.8 m above ground. For emission measurements above 1 GHz, The test equipment was placed on turntable with 1.5 m above ground. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The EUT, cable, wire arrangement and mode of operation that has the highest amplitude relative to the limit was selected. Then, the turn table was rotated from 0˚ to 360˚ and an antenna mast was moved from 1 m to 4 m height to maximize the suspected highest amplitude signal. The final maximized level was recorded.

At frequencies below 1000 MHz, setting the analyzer RBW = 100 KHz, VBW = 300 KHz, Detector = Peak, Trace mode = max hold. At frequencies above 1000 MHz, setting the analyzer RBW = 1 MHz, VBW = 3 MHz, Detector = Peak, Trace mode = max hold.

7. TEST DATA

7.1 RF Power Output, Effective Radiated Power, Equivalent Isotropically Radiated Power

FCC § 22.913(a), 24.232(c), IC RSS-132 Issue 3 5.4, RSS-133 Issue 6 6.4

Test Mode : Set to Lowest channel, Middle channel and Highest channel

Result

GSM 850

Mode	Channel	Frequency (MHz)	ERP (dBm)	ERP Limit (dBm)	EIRP (dBm)	EIRP Limit (dBm)
GPRS	Lowest	824.2	15.97	38.45	18.12	40.60
	Middle	836.6	16.15	38.45	18.30	40.60
	Highest	848.8	16.32	38.45	18.47	40.60

GSM 1900

Mode	Channel	Frequency (MHz)	EIRP (dBm)	EIRP Limit (dBm)
GPRS	Lowest	1 850.2	14.66	33.00
	Middle	1 880.0	13.63	33.00
	Highest	1 909.8	12.57	33.00

Note:

1. ERP or EIRP was calculated by following equation according to ANSI C63.26-2015 clause 5.2.5.5.

ERP or EIRP = P_{Meas} + G_T

ERP or EIRP effective radiated power or equivalent isotropically radiated power, respectively (expressed in the same units as P_{Meas}, e.g., dBm or dBW)

P_{Meas} measured transmitter output power or PSD, in dBm or dBW

*G_T gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP), Directional antenna gain is **0 dBi.***

2. The following equation was used for Base station Simulator offset:

Base station Simulator offset (dB) = Attenuator (dB) + Cable Loss (dB) + SMA Type Connector Loss (dB)

7.2 Peak-to-Average Power Ratio

FCC § 22.913(d), 24.232(d), IC RSS-132 Issue 3 5.4, RSS-133 Issue 6 6.4

Test Mode : Set to Lowest channel, Middle channel and Highest channel

Result

GSM 850

Mode	Channel	Frequency (MHz)	Peak (dBm)	Average (dBm)	PAPR (dB)	Limit (dB)
GPRS	Lowest	824.2	18.73	18.12	0.61	13.00
	Middle	836.6	18.84	18.30	0.54	13.00
	Highest	848.8	18.92	18.47	0.45	13.00

GSM 1900

Mode	Channel	Frequency (MHz)	Peak (dBm)	Average (dBm)	PAPR (dB)	Limit (dB)
GPRS	Lowest	1 850.2	15.57	14.66	0.91	13.00
	Middle	1 880.0	14.97	13.63	1.34	13.00
	Highest	1 909.8	14.21	12.57	1.64	13.00

Note:

1. The following equation was used for Base station Simulator offset:
Base station Simulator offset (dB) = Attenuator (dB) + Cable Loss (dB) + SMA Type Connector Loss (dB)
2.The following equation was used for spectrum offset:
Spectrum offset (dB) = Attenuator (dB) + Cable Loss (dB) + SMA Type Connector Loss (dB)

7.3 Occupied Bandwidth

FCC § 2.1049(h), IC RSS-Gen Issue 5 6.7

Test Mode : Set to Lowest channel, Middle channel and Highest channel

Result

GSM 850

Mode	Channel	Frequency (MHz)	Power Bandwidth (99%) (KHz)	26 dB Bandwidth (KHz)
GPRS	Lowest	824.2	244.80	312.80
	Middle	836.6	246.33	310.60
	Highest	848.8	246.25	309.80

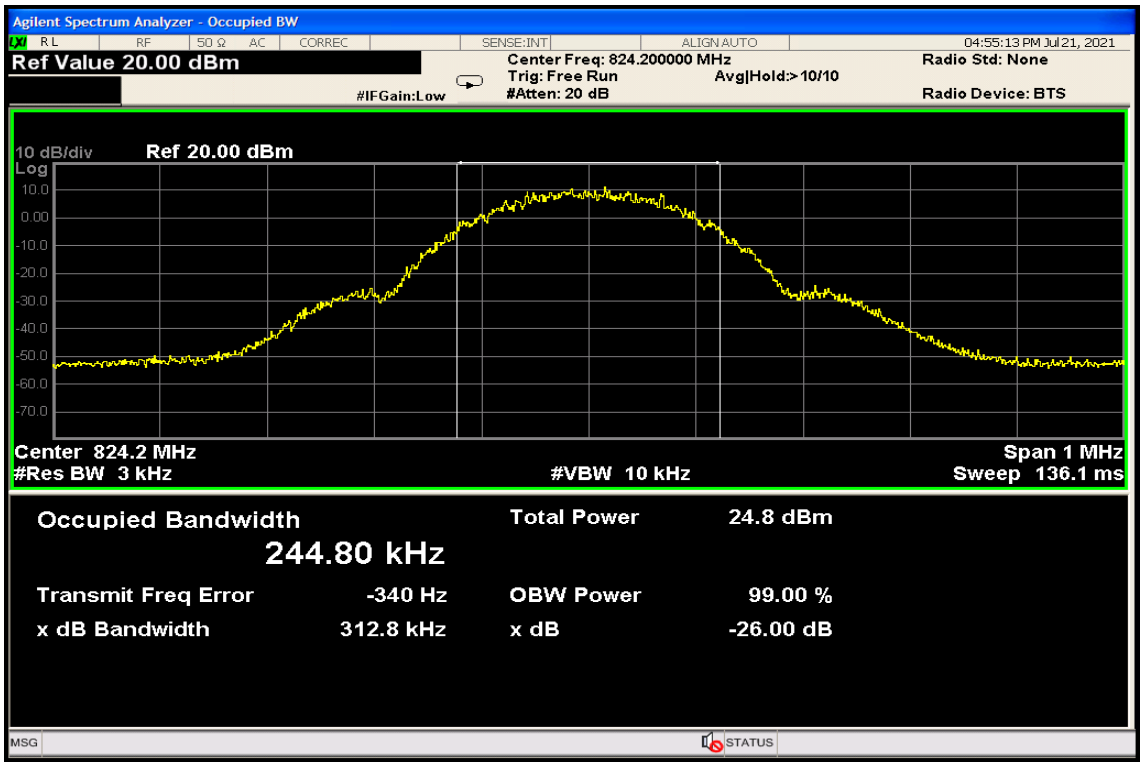
GSM 1900

Mode	Channel	Frequency (MHz)	Power Bandwidth (99%) (KHz)	26 dB Bandwidth (KHz)
GPRS	Lowest	1 850.2	245.99	320.20
	Middle	1 880.0	246.18	323.60
	Highest	1 909.8	245.96	319.10

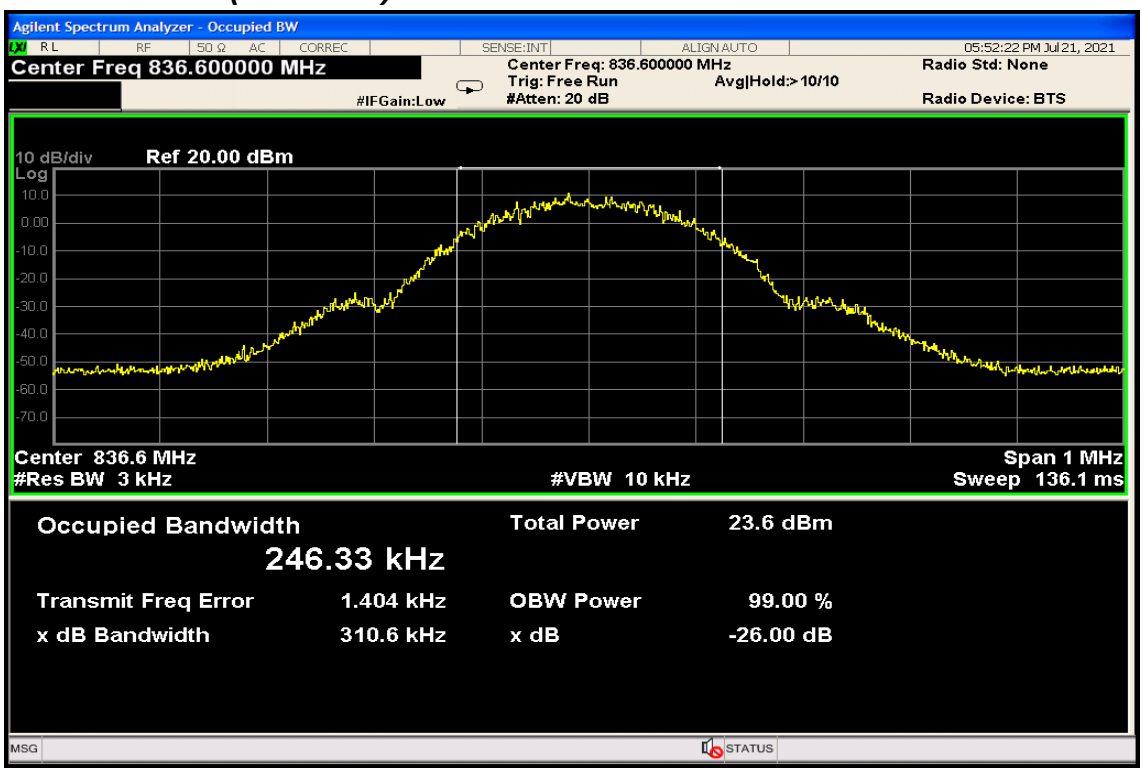
PLOTS OF EMISSIONS

GSM 850

Lowest Channel (824.2 MHz)

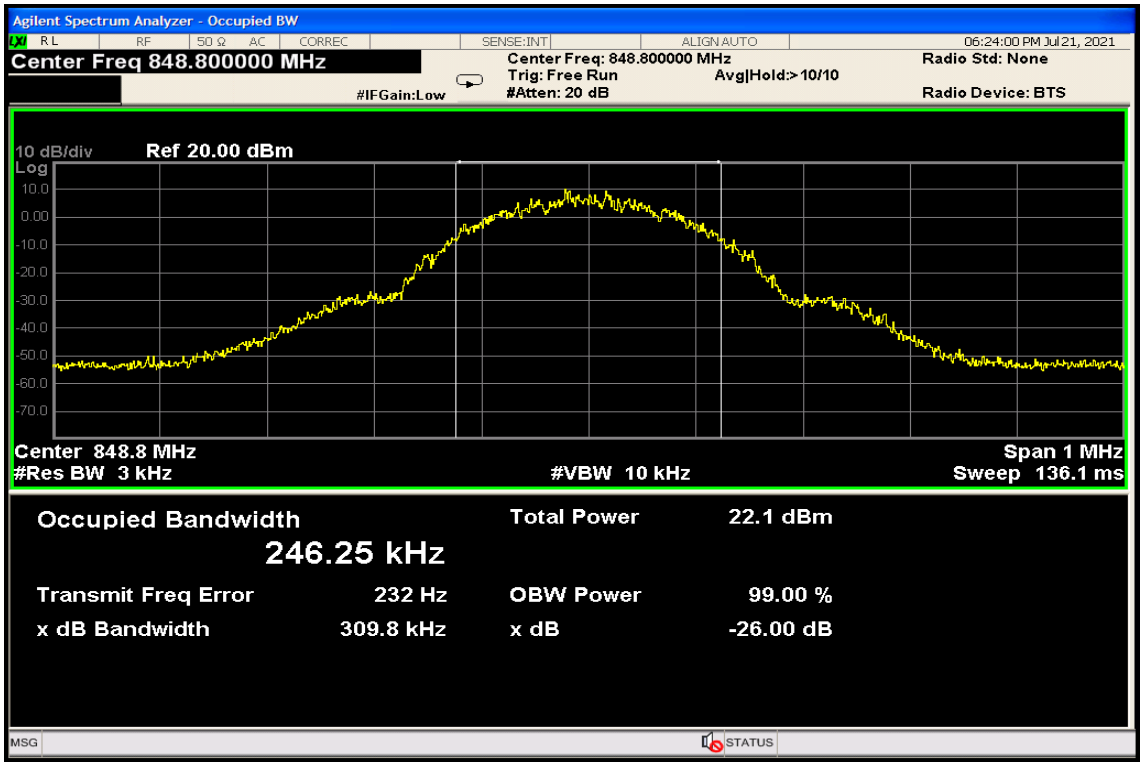


Middle Channel (836.6 MHz)



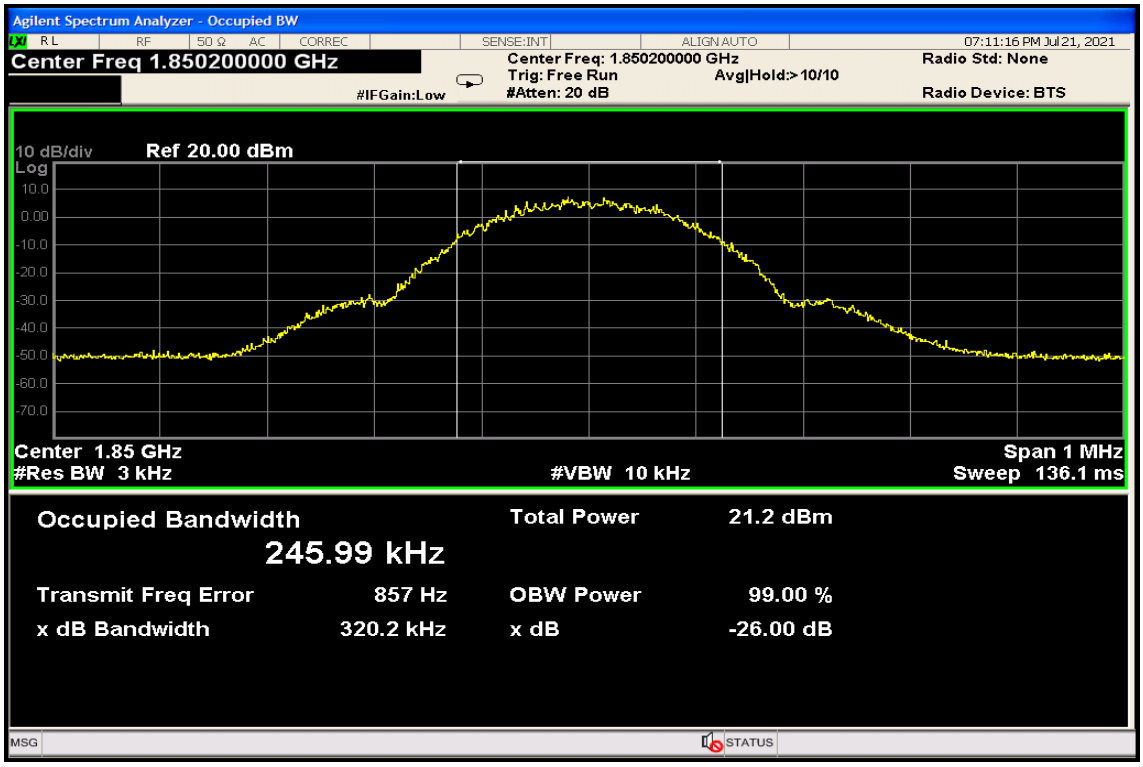
PLOTS OF EMISSIONS

Highest Channel (848.8 MHz)



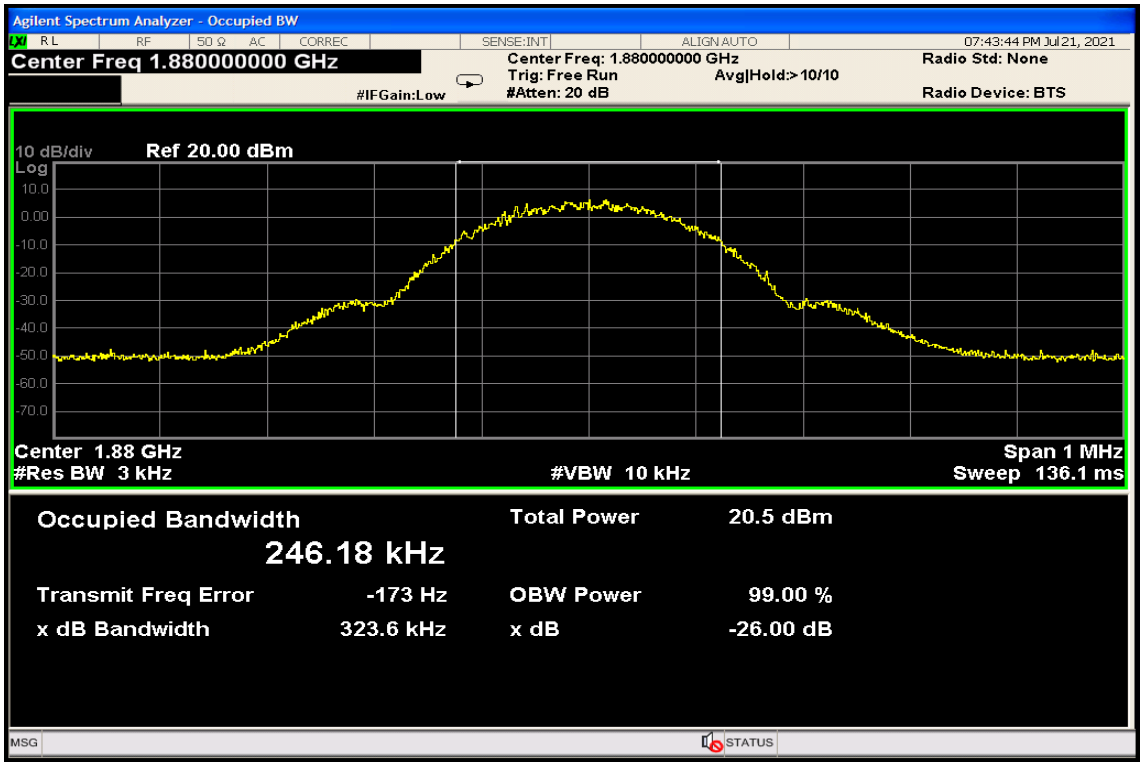
GSM 1900

Lowest Channel (1 850.2 MHz)

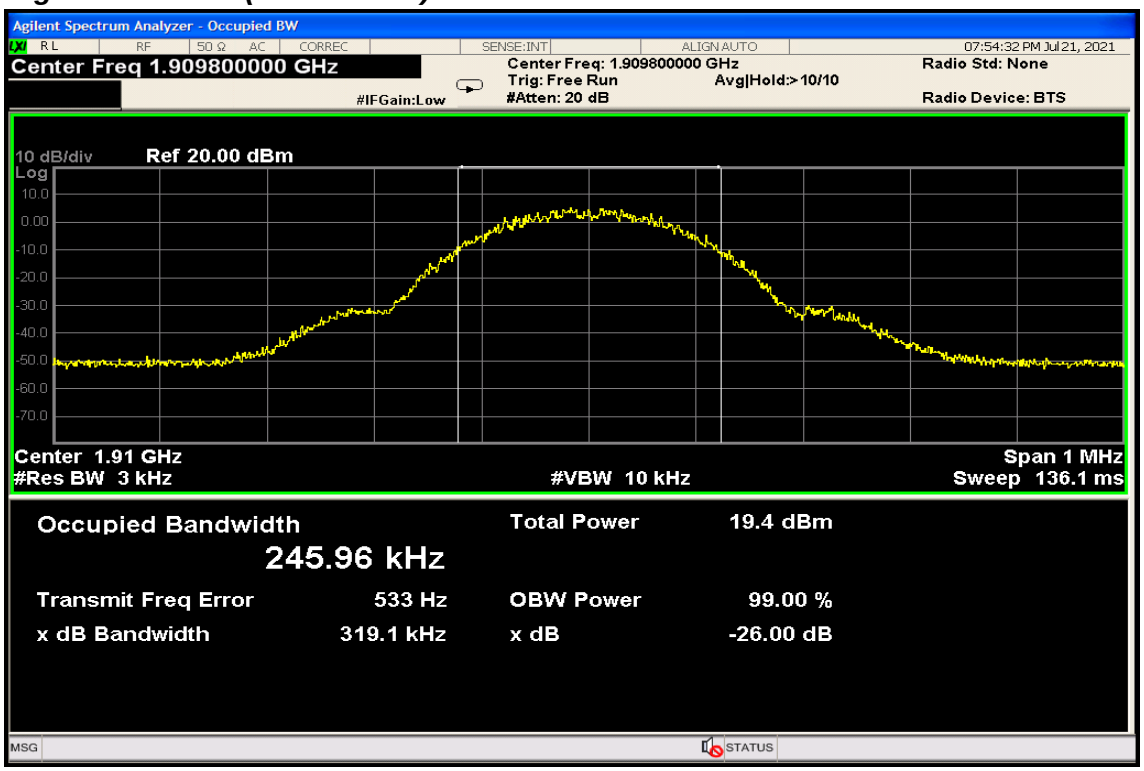


PLOTS OF EMISSIONS

Middle Channel (1 880.0 MHz)



Highest Channel (1 909.8 MHz)



7.4 Band Edge at Antenna Terminals

FCC § 22.917(a), 24.238(a), IC RSS-132 Issue 3 5.5, RSS-133 Issue 6 6.5

Test Mode : Set to Lowest channel and Highest channel

Result

GSM 850

Mode	Channel	Frequency (MHz)	Conducted Spurious Emissions (dBm)	Limit* (dBm)
GPRS	Lowest	824.2	-40.12	-13.00
	Highest	848.8	-42.71	-13.00

GSM 1900

Mode	Channel	Frequency (MHz)	Conducted Spurious Emissions (dBm)	Limit* (dBm)
GPRS	Lowest	1 850.2	-45.44	-13.00
	Highest	1 909.8	-45.59	-13.00

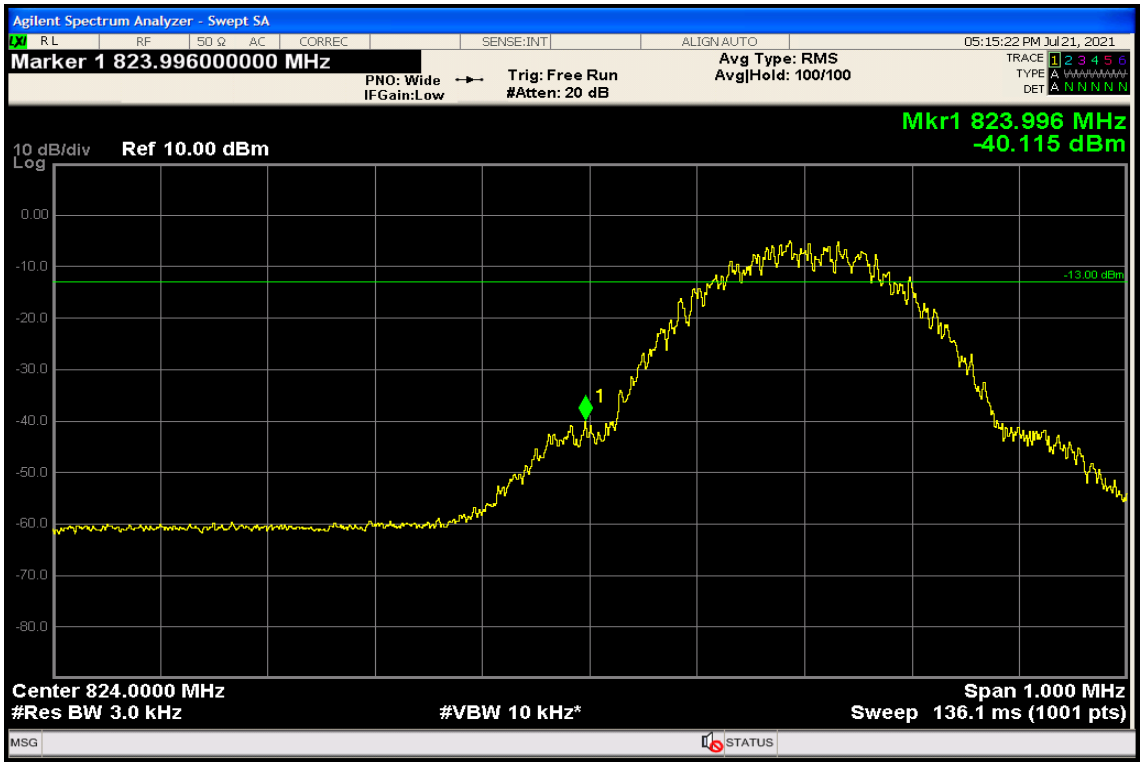
Note:

1. *The cable and attenuator loss from 30 MHz to 20 GHz was reflected in spectrum analyzer with correction factor for the spurious emissions test.*
2. ** 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 (Absolute limit = -13dBm).*

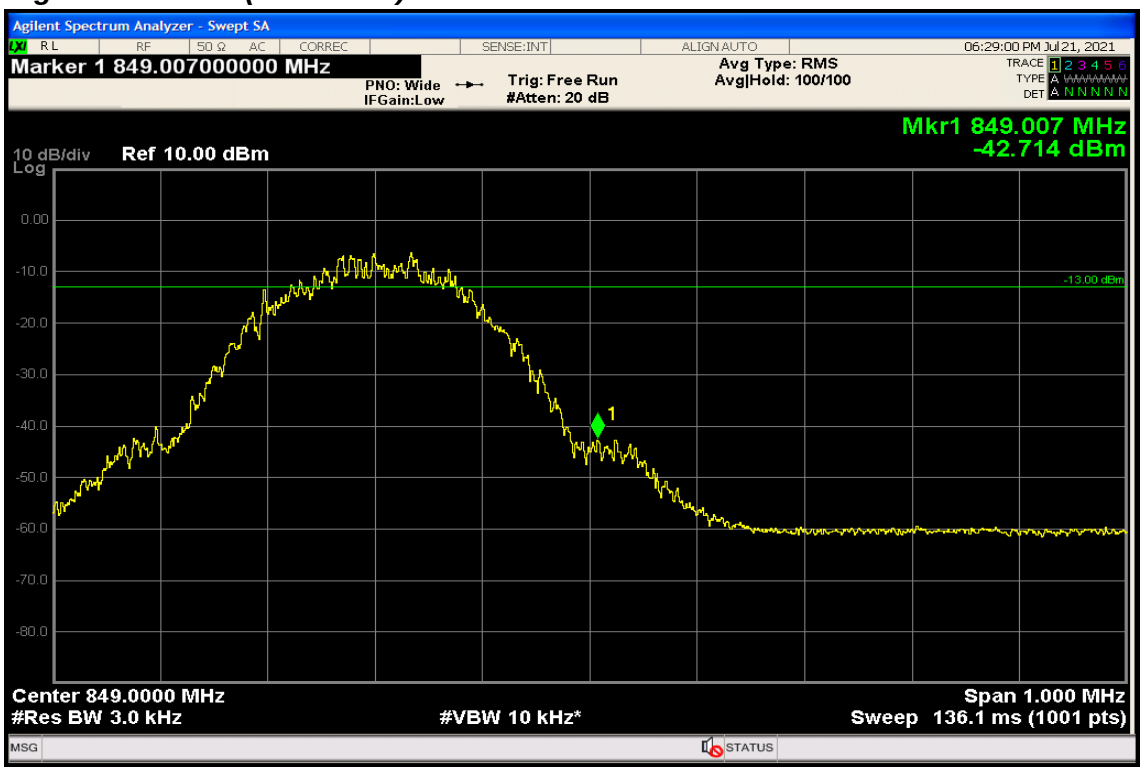
PLOTS OF EMISSIONS

GSM 850

Lowest Channel (824.2 MHz)



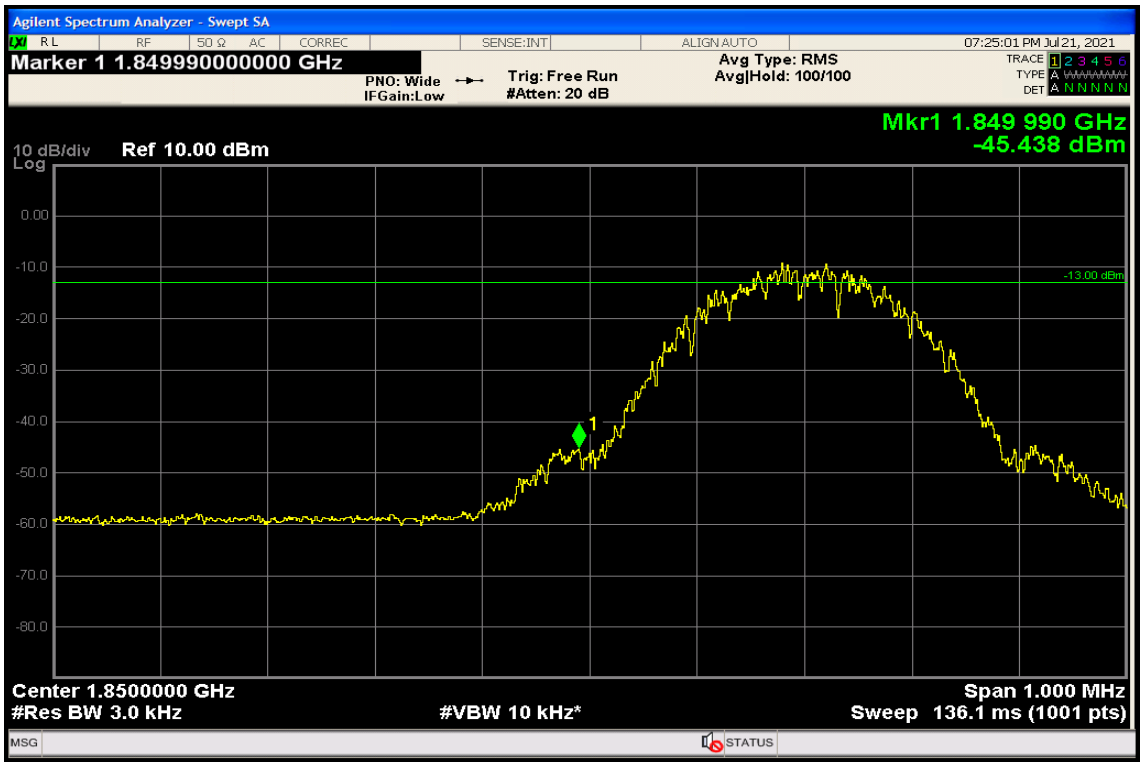
Highest Channel (848.8 MHz)



PLOTS OF EMISSIONS

GSM 1900

Lowest Channel (1 850.2 MHz)



Highest Channel (1 909.8 MHz)

7.5 Spurious Emissions at Antenna Terminals

FCC § 22.917(a), 24.238(a), IC RSS-132 Issue 3 5.5, RSS-133 Issue 6 6.5

Test Mode : Set to Lowest channel, Middle channel and Highest channel

Result

GSM 850

Mode	Channel	Frequency (MHz)	Conducted Spurious Emissions (dBm)	Limit* (dBm)
GPRS	Lowest	824.2	-25.02	-13.00
	Middle	836.6	-24.84	-13.00
	Highest	848.8	-24.94	-13.00

GSM 1900

Mode	Channel	Frequency (MHz)	Conducted Spurious Emissions (dBm)	Limit* (dBm)
GPRS	Lowest	1 850.2	-19.15	-13.00
	Middle	1 880.0	-19.20	-13.00
	Highest	1 909.8	-19.16	-13.00

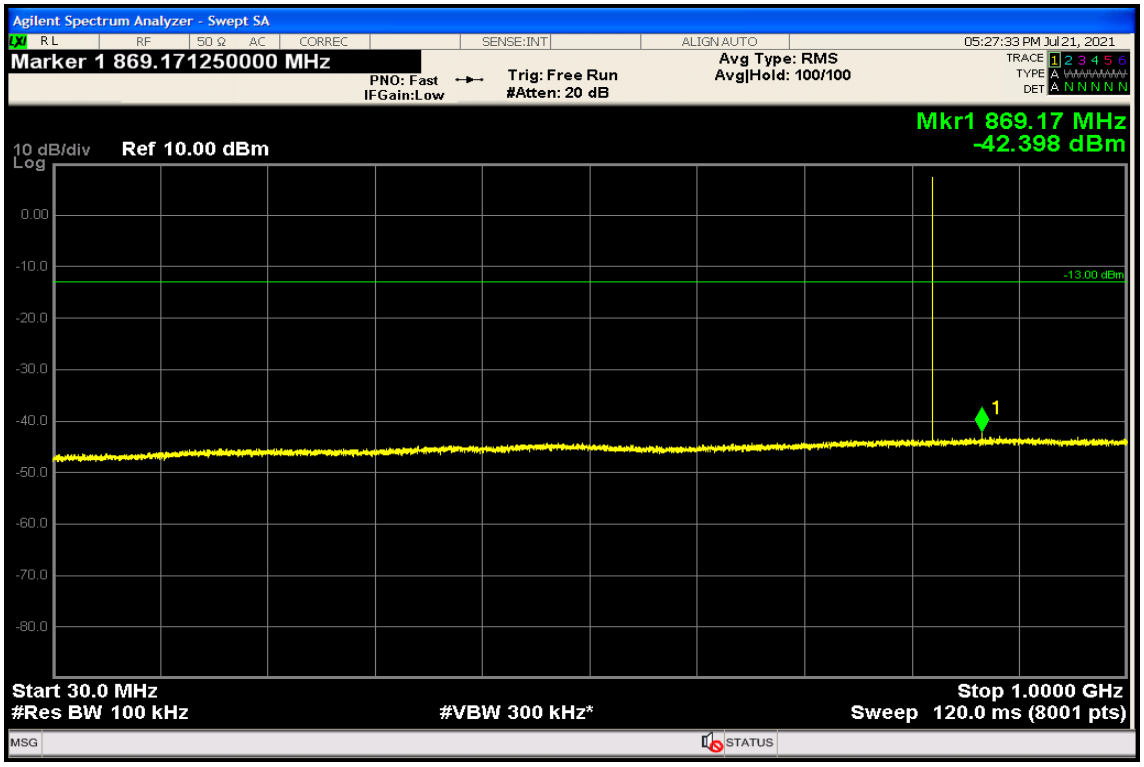
Note:

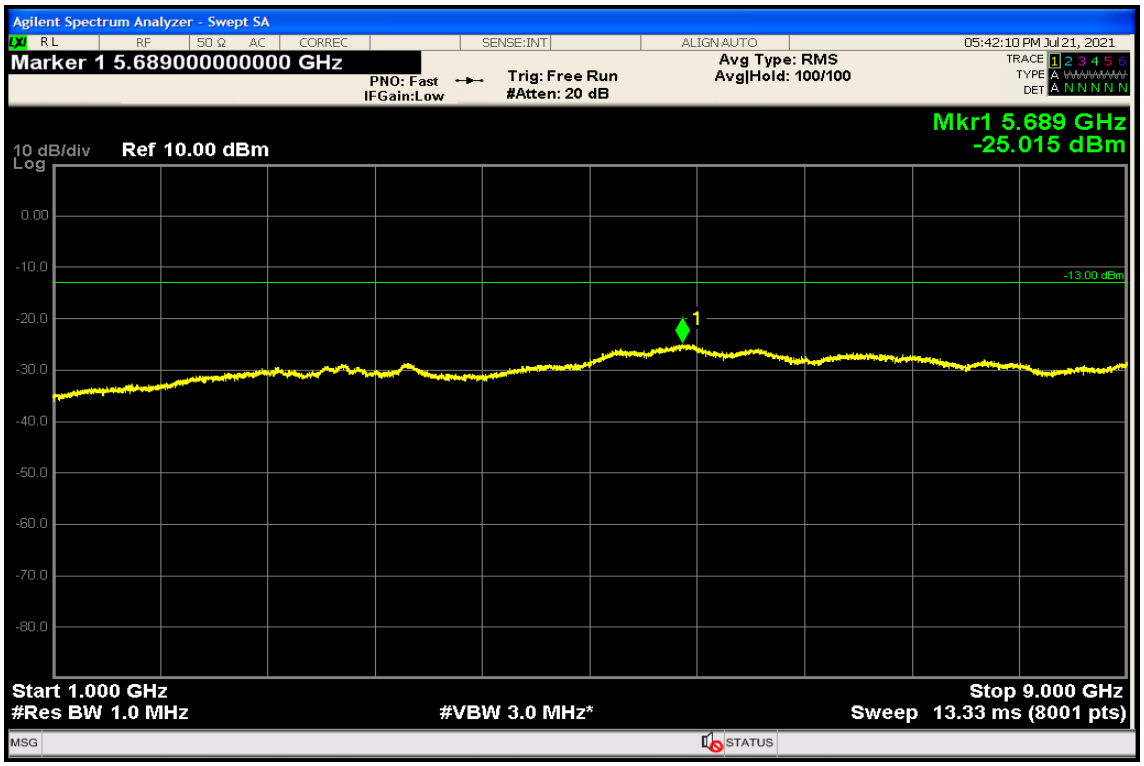
1. *The cable and attenuator loss from 30 MHz to 20 GHz was reflected in spectrum analyzer with correction factor for the spurious emissions test.*
2. ** The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB (Absolute limit = -13dBm).*
3. *Other spurious was under 20 dB below the permissible value.*

PLOTS OF EMISSIONS

GSM 850

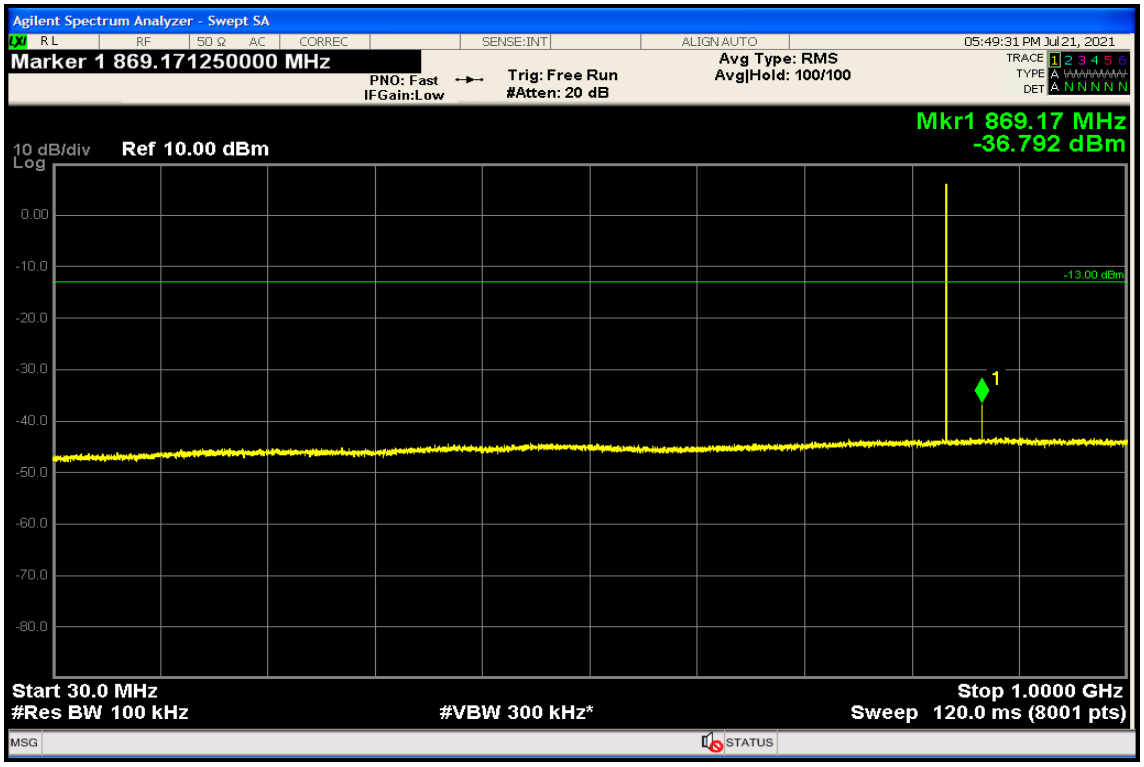
Lowest Channel (824.2 MHz)

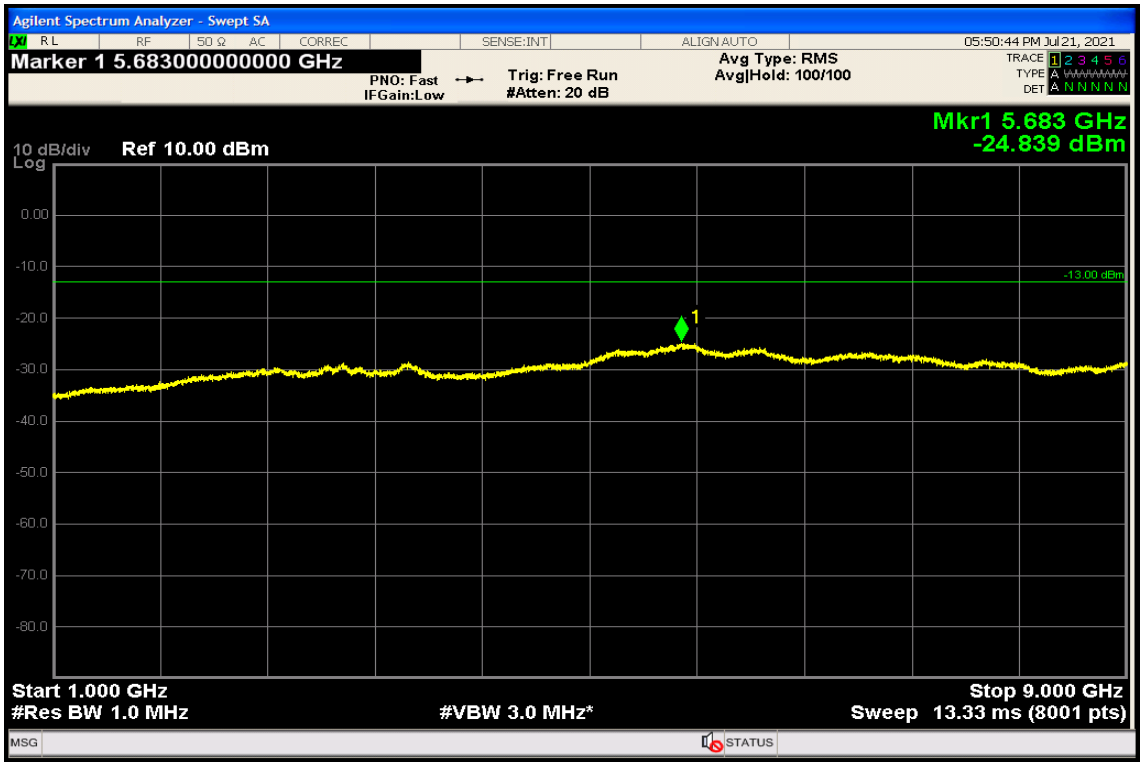




PLOTS OF EMISSIONS

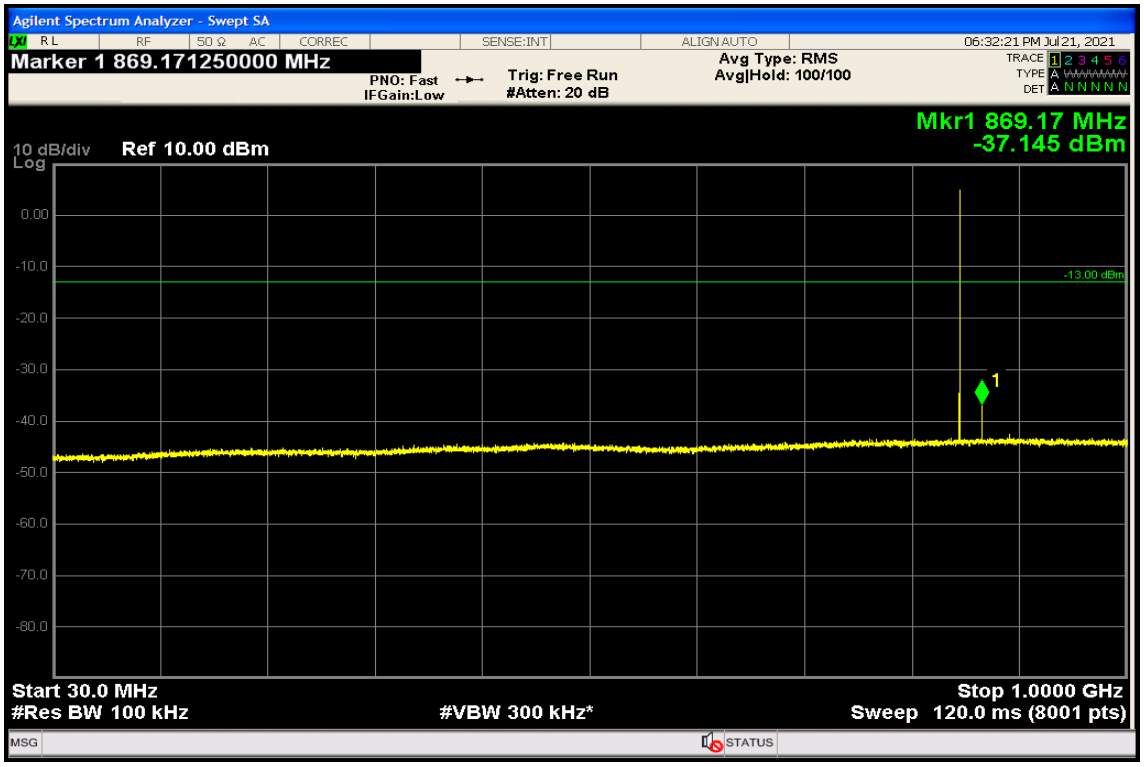
Middle Channel (836.6 MHz)

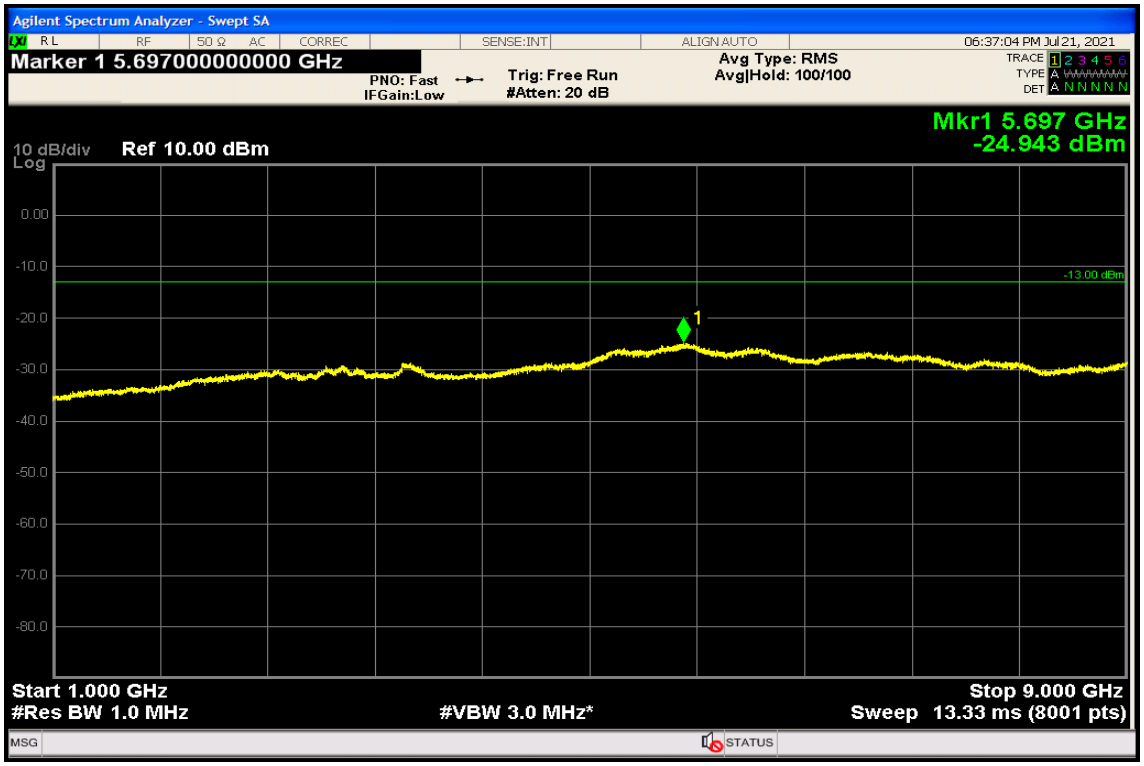




PLOTS OF EMISSIONS

Highest Channel (848.8 MHz)

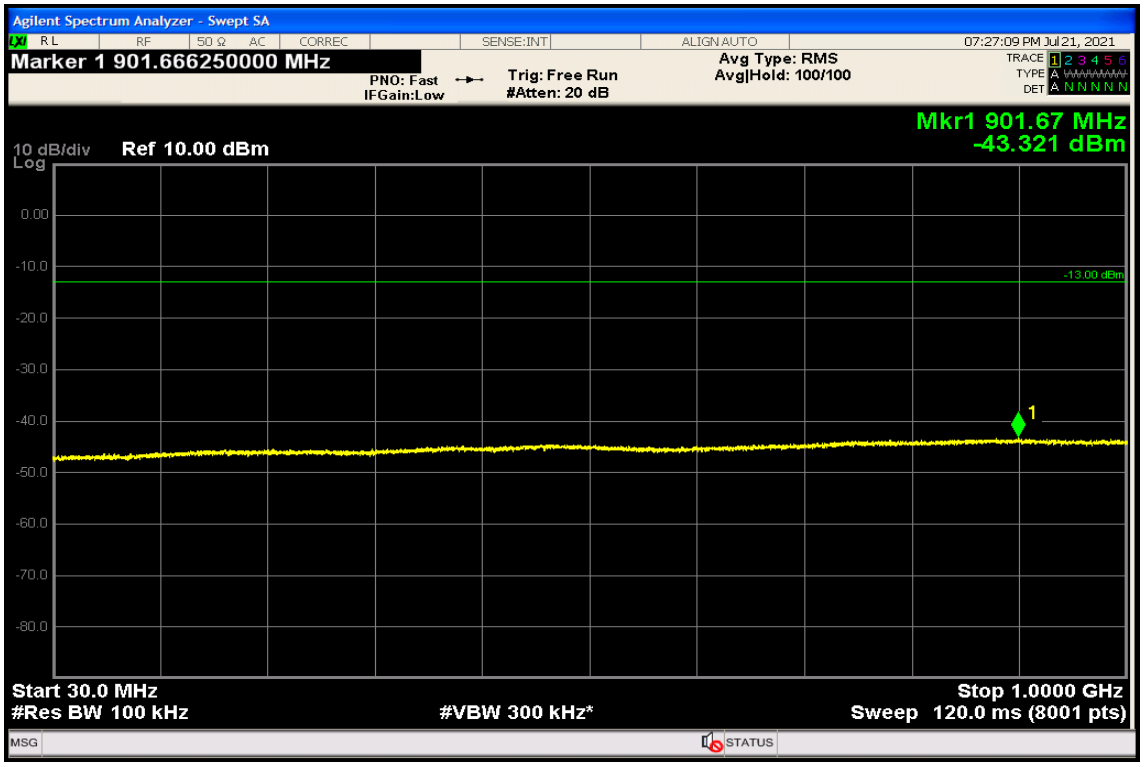


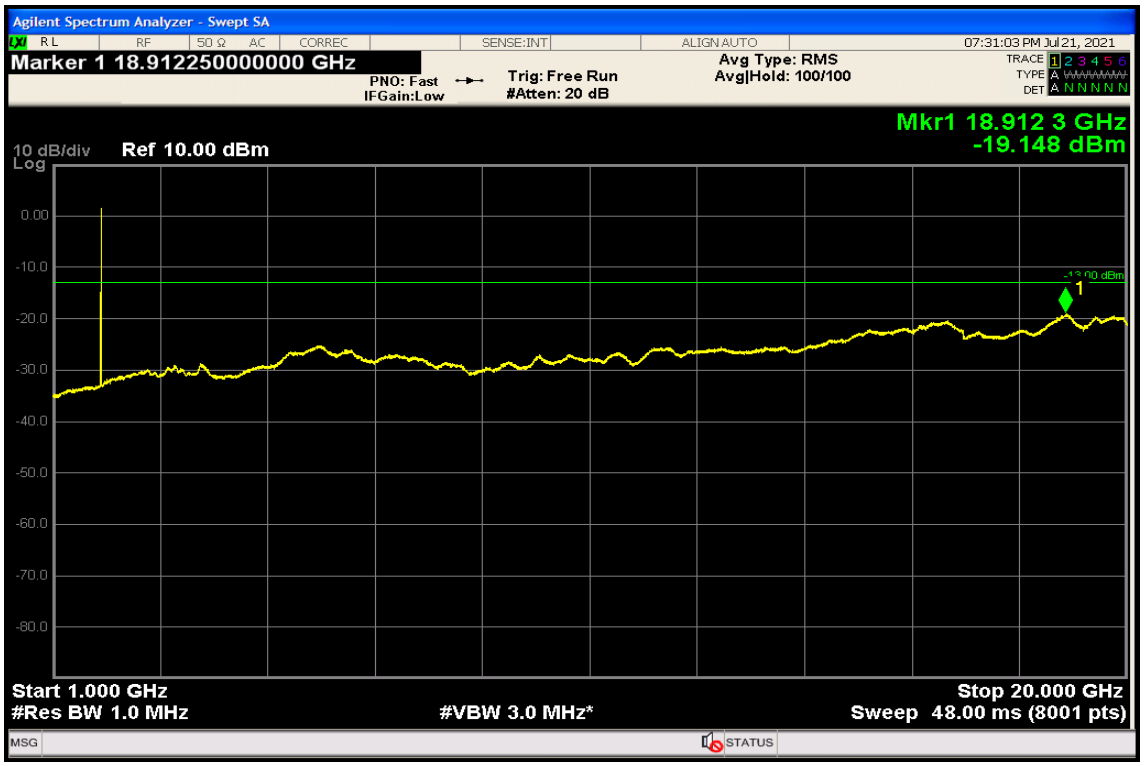


PLOTS OF EMISSIONS

GSM 1900

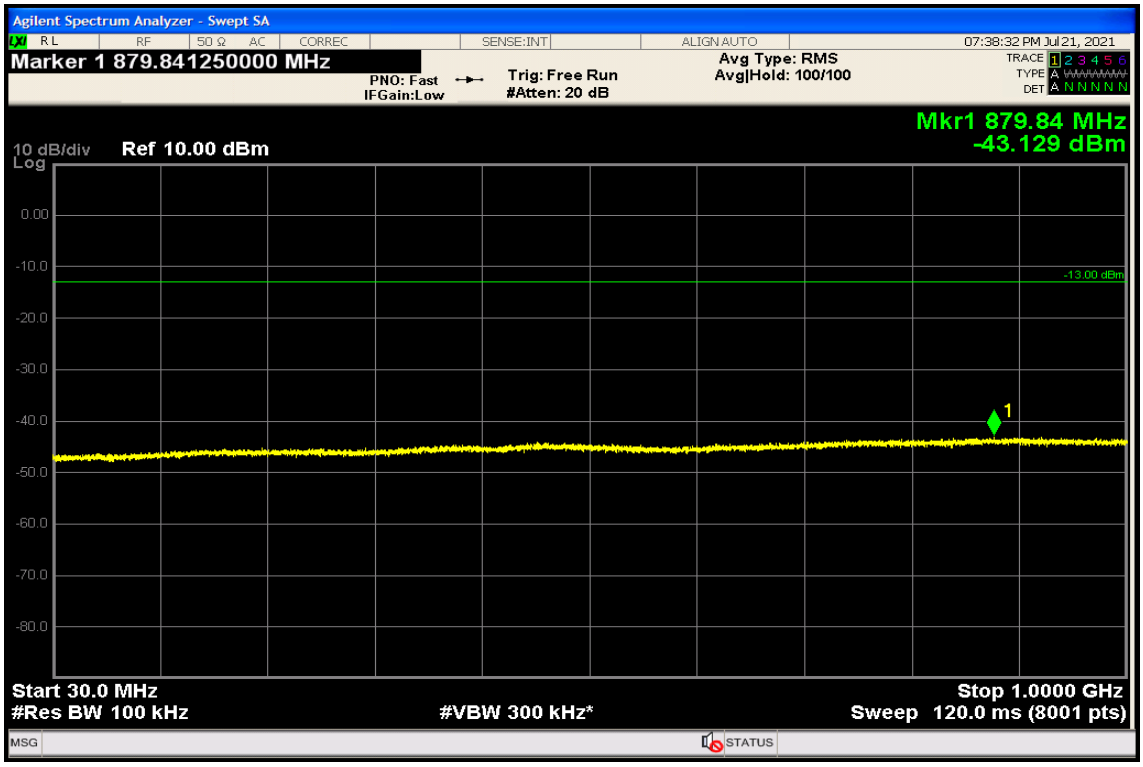
Lowest Channel (1 850.2 MHz)

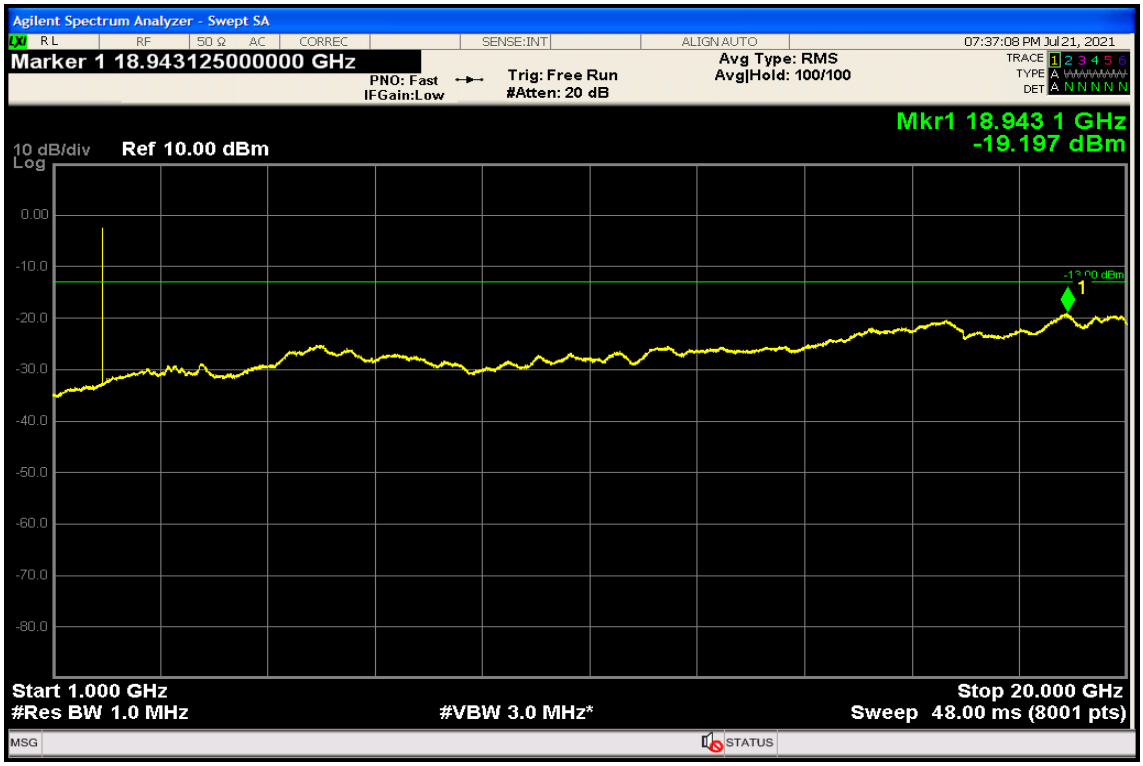




PLOTS OF EMISSIONS

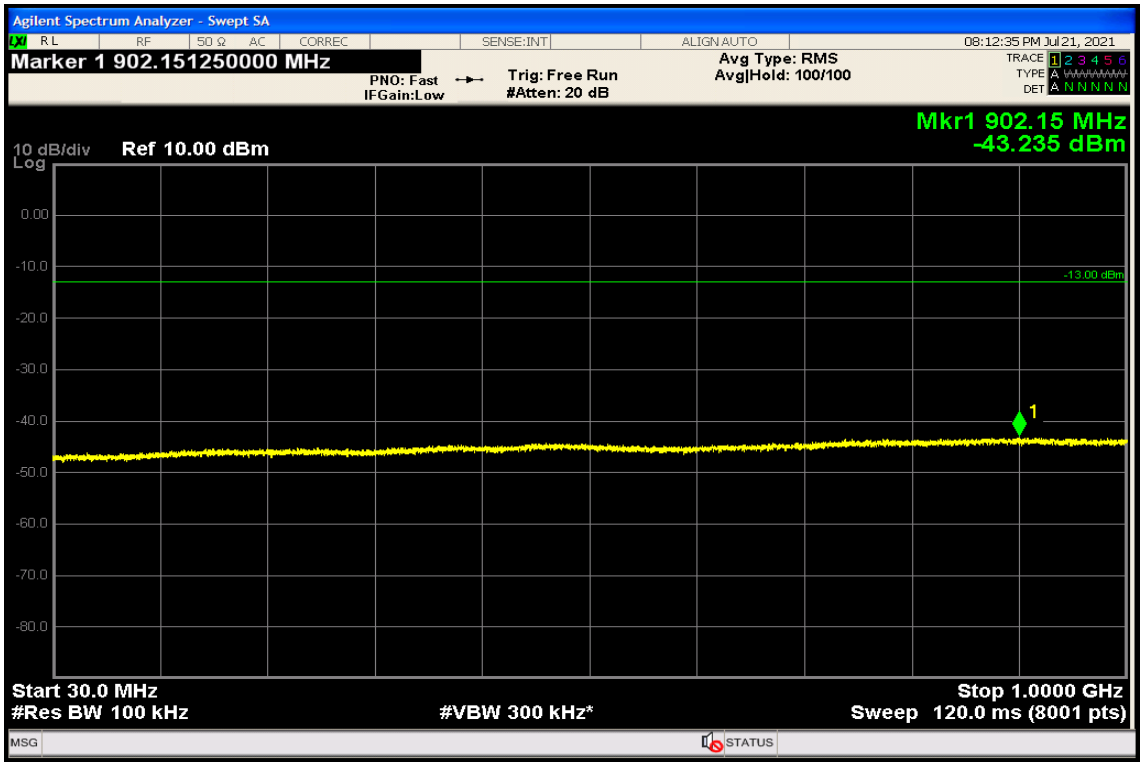
Middle Channel (1 880.0 MHz)

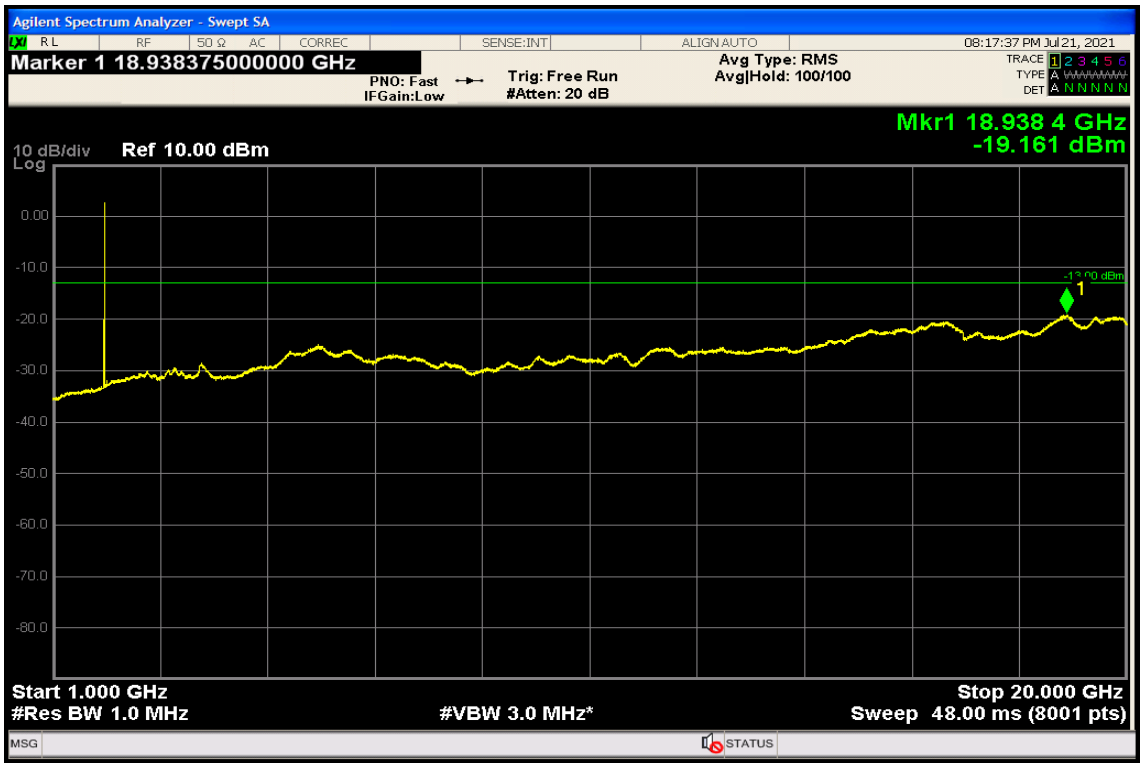




PLOTS OF EMISSIONS

Highest Channel (1 909.8 MHz)





7.6 Frequency Stability

FCC § 22.355, 24.235, IC RSS-132 Issue 3 5.3, RSS-133 Issue 6 6.3

Test Mode : Set to Lowest channel, Middle channel and Highest channel,

Result

GSM 850

Mode	Channel	Frequency (MHz)	Test Temp.	Test Volt.	Test Result (ppm)	Limit (ppm)
GPRS	Lowest	824.2	-30.0	NV	-0.032	±2.5
			-20.0	NV	-0.015	±2.5
			-10.0	NV	-0.024	±2.5
			0.0	NV	-0.018	±2.5
			10.0	NV	-0.022	±2.5
			20.0	NV	-0.025	±2.5
			30.0	NV	-0.023	±2.5
			40.0	NV	-0.020	±2.5
			50.0	NV	-0.024	±2.5
			NT	93.5	-0.041	±2.5
			NT	276	-0.035	±2.5
	Middle	836.6	-30.0	NV	-0.038	±2.5
			-20.0	NV	-0.013	±2.5
			-10.0	NV	-0.021	±2.5
			0.0	NV	-0.015	±2.5
			10.0	NV	-0.018	±2.5
			20.0	NV	-0.024	±2.5
			30.0	NV	-0.023	±2.5
			40.0	NV	-0.025	±2.5
			50.0	NV	-0.027	±2.5
			NT	93.5	-0.044	±2.5
			NT	276	-0.036	±2.5
	Highest	848.8	-30.0	NV	-0.036	±2.5
			-20.0	NV	-0.020	±2.5
			-10.0	NV	-0.028	±2.5
			0.0	NV	-0.017	±2.5
			10.0	NV	-0.015	±2.5
			20.0	NV	-0.030	±2.5
			30.0	NV	-0.020	±2.5
			40.0	NV	-0.024	±2.5
			50.0	NV	-0.027	±2.5
			NT	93.5	-0.047	±2.5
			NT	276	-0.034	±2.5

TEST DATA

GSM 1900

Mode	Channel	Frequency (MHz)	Test Temp.	Test Volt.	Test Result (ppm)	Limit (ppm)
GPRS	Lowest	1 850.2	-30.0	NV	-0.035	±2.5
			-20.0	NV	-0.012	±2.5
			-10.0	NV	-0.017	±2.5
			0.0	NV	-0.018	±2.5
			10.0	NV	-0.018	±2.5
			20.0	NV	-0.023	±2.5
			30.0	NV	-0.018	±2.5
			40.0	NV	-0.015	±2.5
			50.0	NV	-0.016	±2.5
			NT	93.5	-0.010	±2.5
			NT	276	-0.013	±2.5
	Middle	1 880.0	-30.0	NV	-0.037	±2.5
			-20.0	NV	-0.013	±2.5
			-10.0	NV	-0.018	±2.5
			0.0	NV	-0.017	±2.5
			10.0	NV	-0.021	±2.5
			20.0	NV	-0.021	±2.5
			30.0	NV	-0.018	±2.5
			40.0	NV	-0.016	±2.5
			50.0	NV	-0.020	±2.5
			NT	93.5	-0.010	±2.5
			NT	276	-0.013	±2.5
	Highest	1 909.8	-30.0	NV	-0.032	±2.5
			-20.0	NV	-0.018	±2.5
			-10.0	NV	-0.018	±2.5
			0.0	NV	-0.018	±2.5
			10.0	NV	-0.020	±2.5
			20.0	NV	-0.023	±2.5
			30.0	NV	-0.016	±2.5
			40.0	NV	-0.016	±2.5
			50.0	NV	-0.016	±2.5
			NT	93.5	-0.010	±2.5
			NT	276	-0.014	±2.5

Note:
NT : Normal Temperature, NV : Normal Voltage

7.7 Effective Radiated Power, Equivalent Isotropically Radiated Power

FCC § 22.913(a), 24.232(c), IC RSS-132 Issue 3 5.4, RSS-133 Issue 6 6.4

Test Mode : Set to Lowest channel, Middle channel and Highest channel

Result

GSM 850

Mode	Channel	Frequency (MHz)	Pol* (H/V)	AF+CL +Amp* (dB)	Result (dBµV/m)	ERP Result (dBm)	ERP Limit (dBm)	EIRP Result (dBm)	EIRP Limit (dBm)
GPRS	Lowest	824.2	H	-11.60	107.29	9.88	38.45	12.03	40.60
	Middle	836.6	H	-11.60	107.22	9.81	38.45	11.96	40.60
	Highest	848.8	H	-11.20	107.63	10.22	38.45	12.37	40.60

GSM 1900

Mode	Channel	Frequency (MHz)	Pol* (H/V)	AF+CL +Amp* (dB)	Result (dBµV/m)	EIRP Result (dBm)	EIRP Limit (dBm)
GPRS	Lowest	1 850.2	H	-10.50	107.14	11.88	33.00
	Middle	1 880.0	H	-10.40	99.78	4.52	33.00
	Highest	1 909.8	H	-10.30	102.23	6.97	33.00

Note:

*1. *Pol. H = Horizontal V = Vertical*

*2. **AF + CL + Amp. = Antenna Factor + Cable Loss + Amplifier.*

3. The ERP and EIRP testing were made by rotating EUT through three orthogonal axes and rotating the receive antenna with horizontal, Vertical polarization. The worst data was recorded. (X-axis GSM 850 and GSM 1900)

4. EIRP (dBm) = E (dBµV/m) + 20 log D − 104.8; where D is the measurement distance in meters.

5. ERP = EIRP – 2.15 (dB)

7.8 Field Strength of Spurious Radiation

FCC § 22.917(a), 24.238(a), IC RSS-132 Issue 3 5.5, RSS-133 Issue 6 6.5

Test Mode : Set to Lowest channel, Middle channel and Highest channel,

Result

GSM 850

Lowest Channel

Frequency (MHz)	Reading (dBµV)	Pol* (H/V)	AF+CL+Amp* (dB)	Result (dBµV/m)	ERP Result (dBm)	EIRP Result (dBm)	Limit*** (dBm)
869.16	82.19	H	-11.00	71.19	-26.22	-24.07	-13.00
875.95	82.99	H	-11.10	71.89	-25.52	-23.37	-13.00
1 005.67	62.64	H	-11.90	50.74	-46.67	-44.52	-13.00
1 648.33	82.14	H	-11.10	71.04	-26.37	-24.22	-13.00
1 700.20	66.17	H	-11.00	55.17	-42.24	-40.09	-13.00
2 472.60	76.96	H	-7.50	69.46	-27.95	-25.80	-13.00

Middle Channel

Frequency (MHz)	Reading (dBµV)	Pol* (H/V)	AF+CL+Amp* (dB)	Result (dBµV/m)	ERP Result (dBm)	EIRP Result (dBm)	Limit*** (dBm)
876.11	83.34	H	-11.10	72.24	-25.17	-23.02	-13.00
881.55	82.28	H	-11.00	71.28	-26.13	-23.98	-13.00
1 050.93	61.18	H	-11.00	50.18	-47.23	-45.08	-13.00
1 674.47	72.04	H	-11.00	61.04	-36.37	-34.22	-13.00
1 712.40	65.67	H	-10.90	54.77	-42.64	-40.49	-13.00
2 509.93	79.04	H	-7.40	71.64	-25.77	-23.62	-13.00

TEST DATA

Highest Channel

Frequency (MHz)	Reading (dBµV)	Pol* (H/V)	AF+CL+Amp* (dB)	Result (dBµV/m)	ERP Result (dBm)	EIRP Result (dBm)	Limit*** (dBm)
876.00	83.46	H	-11.10	72.36	-25.05	-22.90	-13.00
893.84	82.32	H	-10.70	71.62	-25.79	-23.64	-13.00
1 039.67	60.68	H	-11.30	49.38	-48.03	-45.88	-13.00
1 697.53	76.01	H	-11.00	65.01	-32.40	-30.25	-13.00
1 769.73	58.67	H	-10.80	47.87	-49.54	-47.39	-13.00
2 546.40	61.00	H	-7.30	53.70	-43.71	-41.56	-13.00

GSM 1900

Lowest Channel

Frequency (MHz)	Reading (dBµV)	Pol* (H/V)	AF+CL+Amp* (dB)	Result (dBµV/m)	EIRP Result (dBm)	Limit*** (dBm)
258.76	73.56	H	-22.60	50.96	-44.30	-13.00
1 001.40	60.97	H	-12.00	48.97	-46.29	-13.00
1 930.20	82.12	H	-10.20	71.92	-23.34	-13.00
1 947.73	81.96	H	-10.10	71.86	-23.40	-13.00

TEST DATA

Middle Channel

Frequency (MHz)	Reading (dBµV)	Pol* (H/V)	AF+CL+Amp* (dB)	Result (dBµV/m)	EIRP Result (dBm)	Limit*** (dBm)
266.30	72.83	H	-22.50	50.33	-44.93	-13.00
1 028.20	61.93	H	-11.50	50.43	-44.83	-13.00
1 947.87	74.62	H	-10.10	64.52	-30.74	-13.00
1 959.07	63.32	H	-10.10	53.22	-42.04	-13.00

Highest Channel

Frequency (MHz)	Reading (dBµV)	Pol* (H/V)	AF+CL+Amp* (dB)	Result (dBµV/m)	EIRP Result (dBm)	Limit*** (dBm)
254.07	74.15	H	-22.60	51.55	-43.71	-13.00
1 016.33	59.90	H	-11.80	48.10	-47.16	-13.00
1 947.80	74.65	H	-10.10	64.55	-30.71	-13.00

Note:

*1. *Pol. H = Horizontal V = Vertical*
*2. **AF + CL + Amp. = Antenna Factor + Cable Loss + Amplifier.*
*3. *** 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 (Absolute limit = -13dBm).*
4. The radiated emissions testing were made by rotating EUT through three orthogonal axes and rotating the receive antenna with horizontal, Vertical polarization. The worst data was recorded. (X-axis GSM 850 and Y-axis GSM 1900)
5. EIRP (dBm) = E (dBµV/m) + 20 log D − 104.8; where D is the measurement distance in meters.
6. ERP = EIRP – 2.15 (dB)

8. TEST EQUIPMENT

No.	Instrument	Manufacturer	Model	Serial No.	Calibration Date	Calibration Interval
1	*Test Receiver	R & S	ESU 40	100202	Apr. 05 2021	1 year
2	Test Receiver	R & S	ESCI	101041	Apr. 05 2021	1 year
3	*Attenuator	API technologies	89-30-21	CK7023	Apr. 06 2021	1 year
4	*Temp&Humid Chamber	ESPEC	SH-642	93009405	Jan. 11 2021	1 year
5	*AC POWER SUPPLY	GW Instek	APS-7200	GES181345	Apr. 06 2021	1 year
6	*Signal Generator	R & S	SMB100A	175861	Jul. 13 2021	1 year
7	*Amplifier	R & S	SCU 01	10029	Apr. 06 2021	1 year
8	*Amplifier	R & S	SCU18F	180025	Apr. 06 2021	1 year
9	*Amplifier	R & S	SCU26	10011	Jul. 12 2021	1 year
10	Amplifier	R & S	SCU40	100380	Jul. 12 2021	1 year
11	*WIDEBAND RADIO COMMUNICATION TESTER	R & S	CMW500	127322	Jan. 06 2021	1 year
12	*Spectrum Analyzer	Agilent	N9020A	MY44022567	Jul. 12 2021	1 year
13	*Spectrum Analyzer	R & S	FSW43	104084	Apr. 05 2021	1 year
14	*Loop Antenna	R & S	HFH2-Z2	100279	Feb. 25 2021	1 year
15	*Horn Antenna	SCHWARZBECK	BBHA9120D	9120D-508	Jul. 19 2021	1 year
16	*Horn Antenna	Q-par Angus	QSH20S20	8179	Jul. 14 2021	1 year
17	Horn Antenna	Q-par Angus	QSH22K20	8180	Jul. 14 2021	1 year
18	*Trilog-Broadband Antenna	SCHWARZBECK	VULB 9163	9163-01027	Feb. 07 2020	2 year
19	LISN	R & S	ENV216	101156	Apr. 05 2021	1 year
20	*Position Controller	INNCO	CO2000	12480406/L	N/A	N/A
21	*Controller	INNCO	CO3000	CO3000/937/3833051	N/A	N/A
22	*Turn Table	INNCO	DS1200S	N/A	N/A	N/A
23	*Turn Table	INNCO	DT2000-2t	N/A	N/A	N/A
24	*Antenna Mast	INNCO	MA4000	N/A	N/A	N/A
25	*TILT Antenna Mast	INNCO	MA4640-XP-EP	N/A	N/A	N/A
26	*Open Switch And Control Unit	R & S	OSP-120	100081	N/A	N/A
27	*Open Switch And Control Unit	R & S	OSP-120	101766	N/A	N/A
28	*Shielded Room	Seo-Young EMC	N/A	N/A	N/A	N/A
29	*Anechoic Chamber	Seo-Young EMC	N/A	N/A	N/A	N/A
30	*WiFi Filter Bank	R & S	U083	N/A	N/A	N/A
31	WiFi Filter Bank	R & S	U082	N/A	N/A	N/A

*) Test equipment used during the test

9. ACCURACY OF MEASUREMENT

The Measurement Uncertainties stated were calculated in accordance with the requirements of measurement uncertainty contained in CISPR 16-4-2 with the confidence level of 95%

1. Conducted Uncertainty Calculation

Source of Uncertainty	Xi	Uncertainty of Xi		Coverage factor k	u(Xi) (dB)	Ci	Ci u(Xi) (dB)
		Value (dB)	Probability Distribution				
Receiver reading	RI	± 0.1	normal 1	1.000	0.1	1	0.1
Attenuation AMN-Receiver	LC	± 0.08	normal 2	2.000	0.04	1	0.04
AMN Voltage division factor	LAMN	± 0.8	normal 2	2.000	0.4	1	0.4
Sine wave voltage	dVSW	± 2.00	normal 2	2.000	1.00	1	1.00
Pulse amplitude response	dVPA	± 1.50	rectangular	1.732	0.87	1	0.87
Pulse repetition rate response	dVPR	± 1.50	rectangular	1.732	0.87	1	0.87
Noise floor proximity	dVNF	± 0.00	-	-	0.00	1	0.00
AMN Impedance	dZ	± 1.80	triangular	2.449	0.73	1	0.73
ⓐ Mismatch	M	+ 0.70	U-Shaped	1.414	0.49	1	0.49
ⓑ Mismatch	M	- 0.80	U-Shaped	1.414	- 0.56	1	- 0.56
Measurement System Repeatability	RS	0.05	normal 1	1.000	0.05	1	0.05
Remark	ⓐ: AMN-Receiver Mismatch : + ⓑ: AMN-Receiver Mismatch : -						
Combined Standard Uncertainty	Normal			± 1.88			
Expended Uncertainty U	Normal (k = 2)			± 3.76			

2. Radiation Uncertainty Calculation

Source of Uncertainty	Xi	Uncertainty of Xi		Coverage factor k	u(Xi) (dB)	Ci	Ci u(Xi) (dB)
		Value (dB)	Probability Distribution				
Measurement System Repeatability	**RS**	0.34	normal 1	1.00	0.34	1	0.34
Receiver reading	**Ri**	± 0.02	normal 2	2.00	0.01	1	0.01
Sine wave voltage	**dVsw**	± 0.17	normal 2	2.00	0.09	1	0.09
Pulse amplitude response	**dVpa**	± 0.92	normal 2	2.00	0.46	1	0.46
Pulse repetition rate response	**dVpr**	± 0.35	normal 2	2.00	0.18	1	0.18
Noise floor proximity	**dVnf**	± 0.50	normal 2	2.00	0.25	1	0.25
Antenna Factor Calibration	**AF**	± 2.00	rectangular	$\sqrt{3}$	1.15	1	1.15
Cable Loss	**CL**	± 1.00	normal 2	2.00	0.50	1	0.50
Antenna Directivity	**AD**	± 0.00	rectangular	$\sqrt{3}$	0.00	1	0.00
Antenna Factor Height Dependence	**AH**	± 2.00	rectangular	$\sqrt{3}$	1.15	1	1.15
Antenna Phase Centre Variation	**AP**	± 0.20	rectangular	$\sqrt{3}$	0.12	1	0.12
Antenna Factor Frequency Interpolation	**Ai**	± 0.25	rectangular	$\sqrt{3}$	0.14	1	0.14
Site Imperfections	**Si**	± 4.00	triangular	$\sqrt{6}$	1.63	1	1.63
Measurement Distance Variation	**DV**	± 0.60	rectangular	$\sqrt{3}$	0.35	1	0.35
Antenna Balance	**Dbal**	± 0.90	rectangular	$\sqrt{3}$	0.52	1	0.52
Cross Polarisation	**DCross**	± 0.00	rectangular	$\sqrt{3}$	0.00	1	0.18
Mismatch	**M**	+ 0.98 - 1.11	U-Shaped	$\sqrt{2}$	0.74	1	0.74
EUT Volume Diameter	**Vd**	0.33	normal 1	1.00	0.33	1	0.11
Remark							
Combined Standard Uncertainty	Normal						
Expended Uncertainty U	Normal (k = 2)						