





FCC TEST REPORT FCC 47 CFR Part 22H Industry Canada RSS-132, Issue 2 Cellular Telephones Operating in the Bands 824-849MHz and 869-894MHz FCC 47 CFR Part 24E ISED RSS-133, Issue 5 2GHz Personal Communication Services	
Report Reference No.:	G0M-1901-8021-TFC224GS-V01
Testing Laboratory:	Eurofins Product Service GmbH
Address:	Storkower Str. 38c 15526 Reichenwalde Germany
Accreditation	    <small>Deutsche Akkreditierungsstelle D-PL-12092-01-03</small> <small>Deutsche Akkreditierungsstelle D-PL-12092-01-04</small> DAkkS - Registration number : D-PL-12092-01-03 (ISED) ISED Testing Laboratory site: 3470A-2 DAkkS - Registration number : D-PL-12092-01-04 (FCC) FCC Filed Test Laboratory, Reg.-No.: 96970
Applicant's name:	IAV automotive Engineering Inc.
Address:	15620 technology Drive 48168 Northville United States
Test specification:	
Standard	47 CFR Part 22H, 47 CFR Part 24E RSS-132, Issue 3: 2013-01, RSS-133, Issue 6: 2013-01
Test scope.....	partial Radio compliance test
Equipment under test (EUT):	
Product description	Telemetry Equipment
Model No.	TDBOX2
Additional Model(s)	None
Brand Name(s)	None
Hardware version	IAV-G-00057-01-AA-V02-R01_CI01 and IAV-G-00057-01-AA-V02-R02_CI03
Firmware / Software version	Frontend 0109 / Telemetrie 0211
	FCC-ID: 2AS2J-G00057-01 IC: 24891-G0005701
Test result	Passed

Possible test case verdicts:

- neither assessed nor tested : N/N
- required by standard but not appl. to test object : N/A
- required by standard but not tested : N/T
- not required by standard for the test object : N/R
- test object does meet the requirement : P (Pass)
- test object does not meet the requirement : F (Fail)

Testing:

Test Lab Temperature : 20 – 23 °C

Test Lab Humidity : 32 – 38 %

Date of receipt of test item : 2019-02-14

Date (s) of performance of tests : 2019-02-20 - 2019-07-23

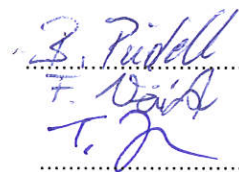
Compiled by : Burkhard Pudell

Tested by (+ signature) : Burkhard Pudell,
(Responsible for Test) : Florian Voigt

Approved by (+ signature) : Toralf Jahn
(Deputy Head of Lab)

Date of issue : 2019-08-13

Total number of pages : 46


General remarks:

The test results presented in this report relate only to the object tested.

The results contained in this report reflect the results for this particular model and serial number. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report.

This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.

Additional comments:

Test case reduction on radiated measurements only is based on the requirements for host integration for full modular approved transmitter modules (KDB 996369 D02) used by the EUT. The EUT uses a module with full modular approval according to FCC and IC rules. For details about the radio module see EUT description in section 1.

Version History

Version	Issue Date	Remarks	Revised by
01	2019-08-13	Initial Release	

REPORT INDEX

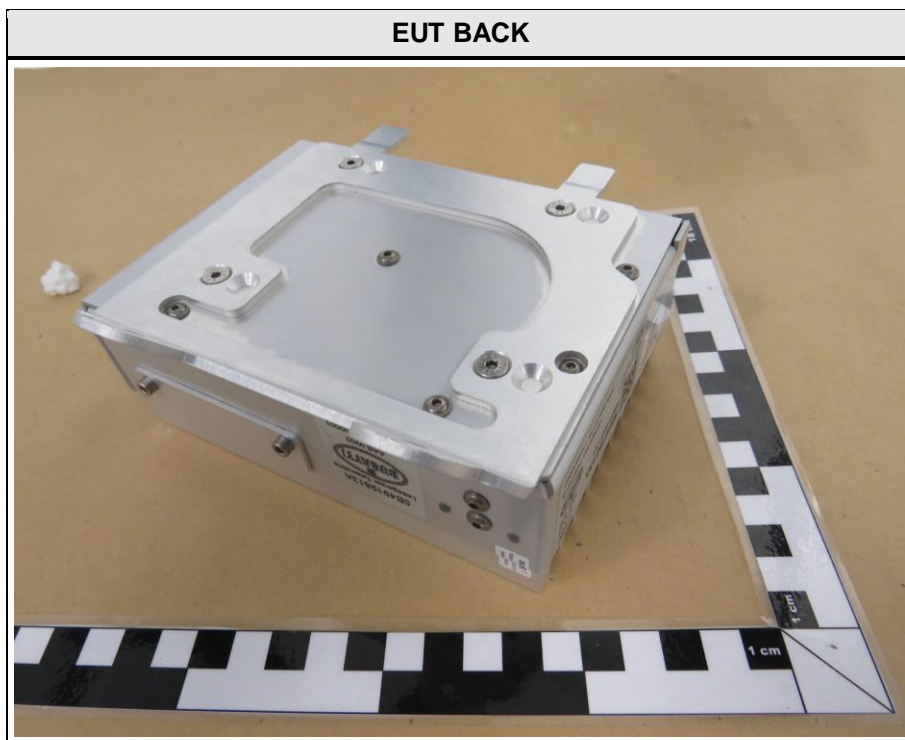
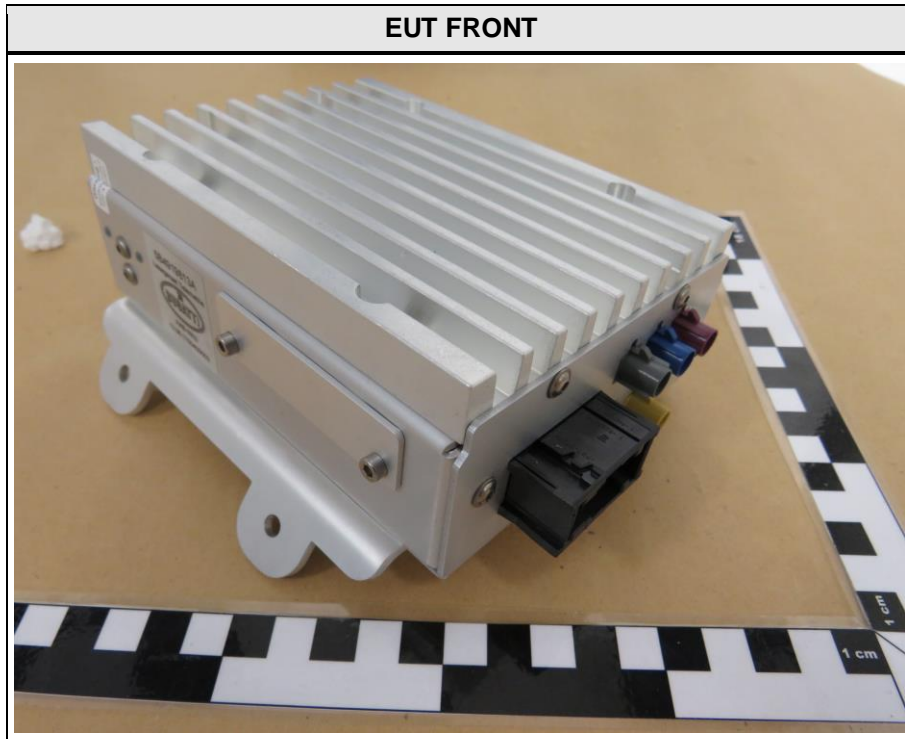
1	EQUIPMENT (TEST ITEM) DESCRIPTION	5
1.1	Photos – Equipment External	7
1.2	Photos – Equipment internal	10
1.3	Photos – Test setup	12
1.4	Supporting Equipment Used During Testing	14
1.5	Test Modes	15
1.6	Test Equipment Used During Testing	16
1.7	Sample emission level calculation	17
2	RESULT SUMMARY	18
3	TEST CONDITIONS AND RESULTS	19
3.1	Test Conditions and Results – Occupied Bandwidth	19
3.2	Test Conditions and Results – Effective radiated power / Equivalent isotropic radiated power	39
3.3	Test Conditions and Results – Transmitter radiated emissions	42
3.4	Test Conditions and Results – Receiver radiated emissions	45

1 Equipment (Test item) Description

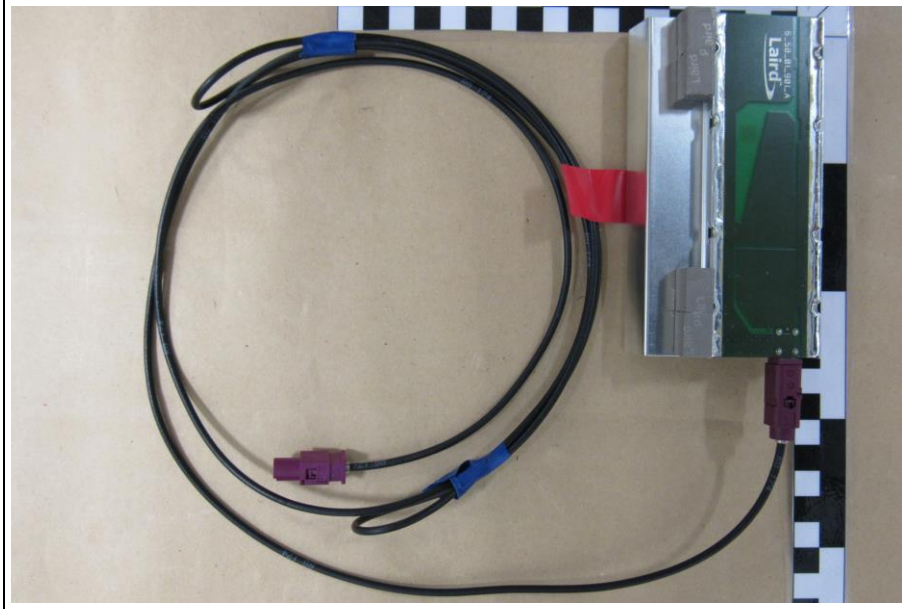
Description	Telemetry Equipment		
Model	TDBOX2		
Additional Model(s)	None		
Brand Name(s)	None		
Serial number	1700400005		
Hardware version	IAV-G-00057-01-AA-V02-R01_CI01 and IAV-G-00057-01-AA-V02-R02_CI03		
Software / Firmware version	Frontend 0109 / Telemetrie 0211		
PMN	TDBOX2		
HVIN	G00057-01		
FVIN	0209		
HMN	None		
Equipment type	End product		
Equipment classification	Mobile Device (Human Body distance > 20 cm)		
Radio type	Transceiver		
Radio technology	GSM850 / PCS1900 / W-CDMA FDD		
Assigned frequency band	Cell. Service Block A & B : 824 - 849 MHz & 869 - 894 MHz Broadband PCS : 1850 - 1910 MHz & 1930 - 1990 MHz		
Main test frequencies GSM850	F _{LOW}	CH : 128 UL: 824.2 MHz	CH : 128 DL: 869.2 MHz
	F _{MID}	CH : 188 UL: 836.2 MHz	CH : 188 DL: 881.2 MHz
	F _{HIGH}	CH : 251 UL: 848.8 MHz	CH : 251 DL: 893.8 MHz
Main test frequencies GSM1900	F _{LOW}	CH : 512 UL: 1850.2 MHz	CH : 512 DL: 1930.2 MHz
	F _{MID}	CH : 661 UL: 1880.0 MHz	CH : 661 DL: 1960.0 MHz
	F _{HIGH}	CH : 810 UL: 1909.8 MHz	CH : 810 DL: 1989.8 MHz
Main test frequencies W-CDMA FDD V	F _{LOW}	CH : 4133 UL: 826.6 MHz	CH : 4358 DL: 871.6 MHz
	F _{MID}	CH : 4175 UL: 835.0 MHz	CH : 4400 DL: 880.0 MHz
	F _{HIGH}	CH : 4232 UL: 846.4 MHz	CH : 4457 DL: 891.4 MHz
Main test frequencies W-CDMA FDD II	F _{LOW}	CH : 9263 UL: 1852.6 MHz	CH : 9663 DL: 1932.6 MHz
	F _{MID}	CH : 9400 UL: 1880.0 MHz	CH : 9800 DL: 1960.0 MHz
	F _{HIGH}	CH : 9537 UL: 1907.4 MHz	CH : 9937 DL: 1987.4 MHz

Radio module	Type	GPS/2G/3G module
	Model	PXS8
	Manufacturer	Gemalto Cinterion
	HW Version	B2
	SW Version	03.001
	FCC-ID	QIPPXS8
	IC	7830A-PXS8
Supported transmission modes	GSM, GPRS, EDGE, RMC, HSDPA	
Modulations	GMSK, 8PSK, QPSK, 16QAM	
Number of antennas	1	
Antenna	Type	external dedicated
	Model	65801
	Manufacturer	Laird Technologies
	Gain	2.7dBi @836MHz (by measurement) 2.3dBi @1880MHz (by measurement)
Manufacturer	IAV automotive Engineering Inc. 15620 technology Drive 48168 Northville United States	
Power supply	V _{NOM}	13.5 VDC (Car power)
	V _{MIN}	N/A
	V _{MIN}	N/A
AC/DC-Adaptor	Model	N/A
	Vendor	N/A
	Input	N/A
	Output	N/A

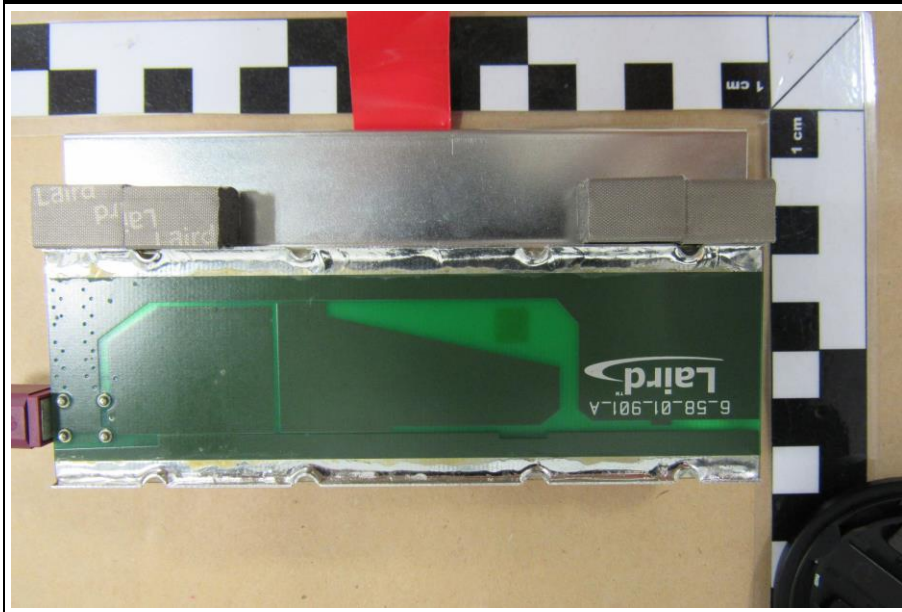
1.1 Photos – Equipment External

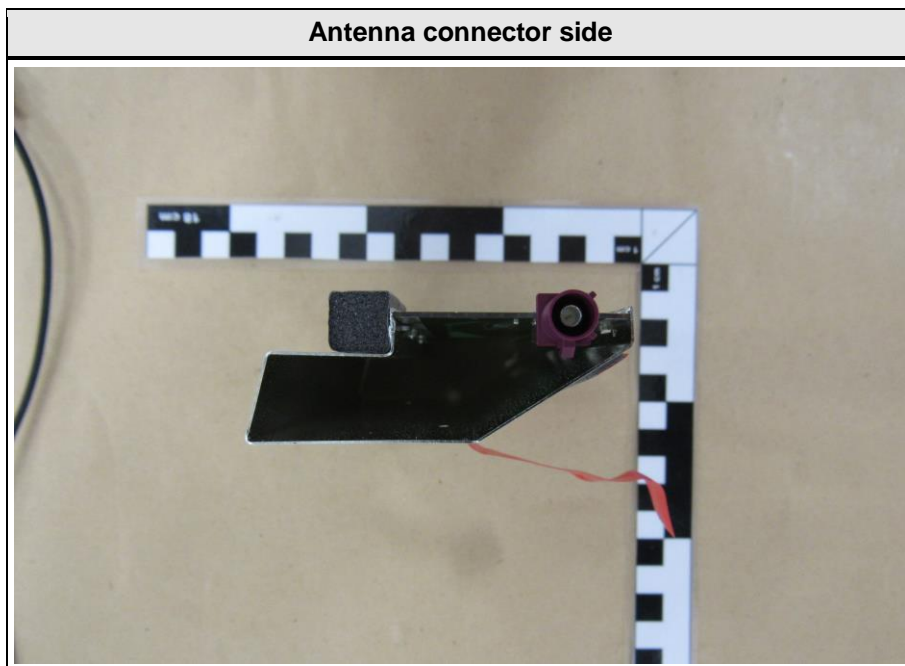
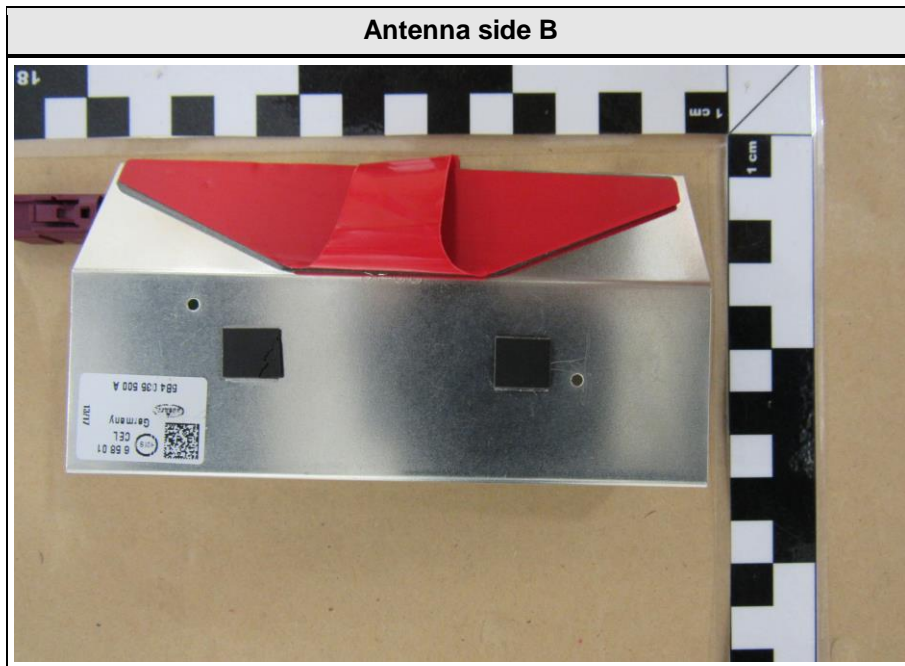


Antenna with associated 196cm RG-174 cable

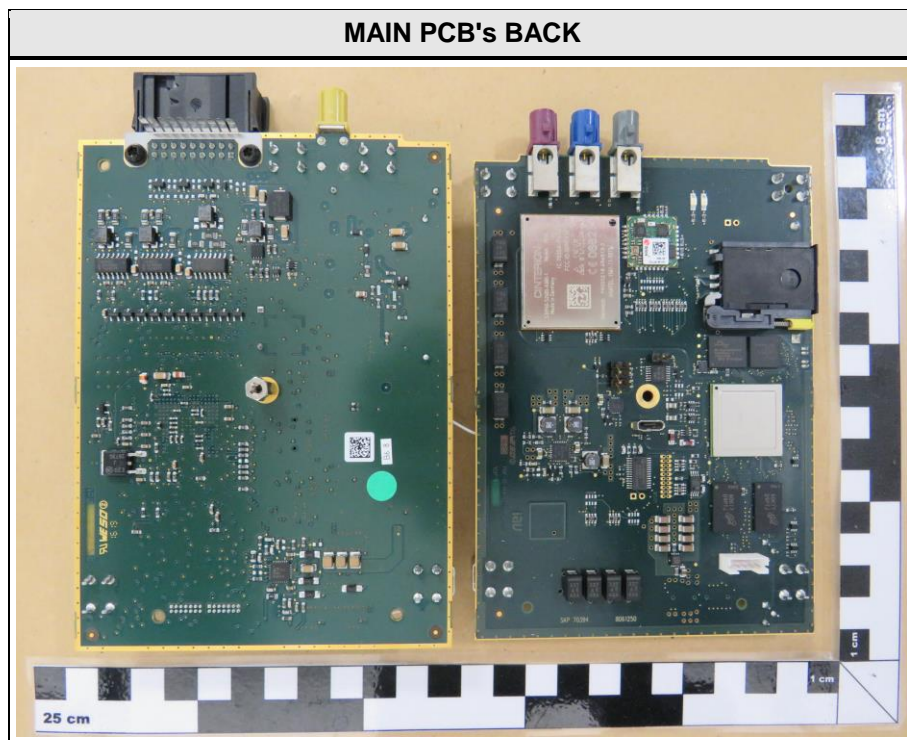
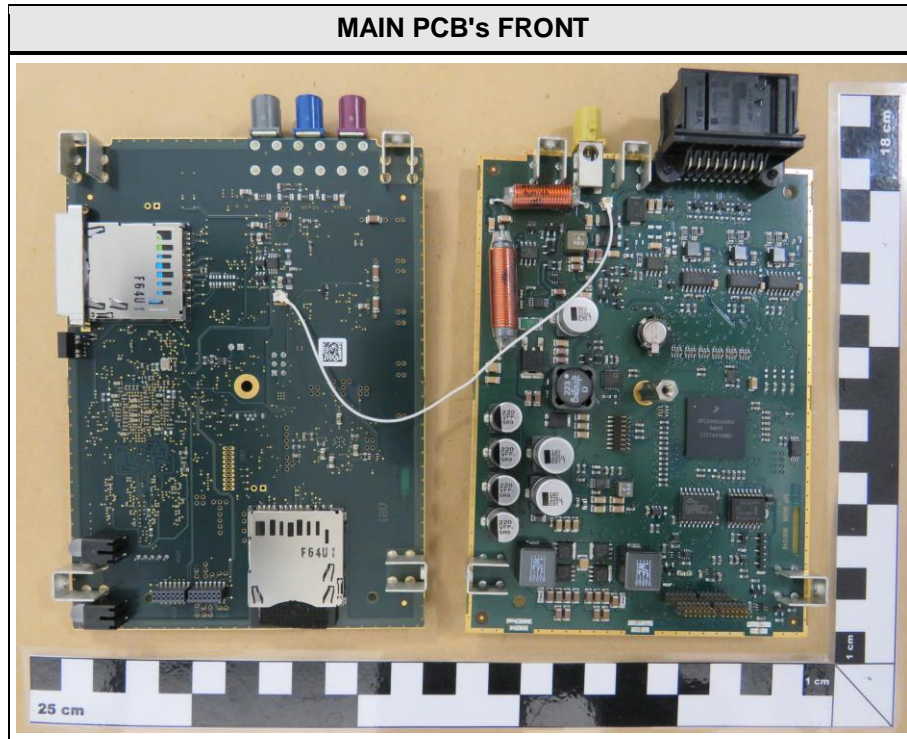


Antenna side A

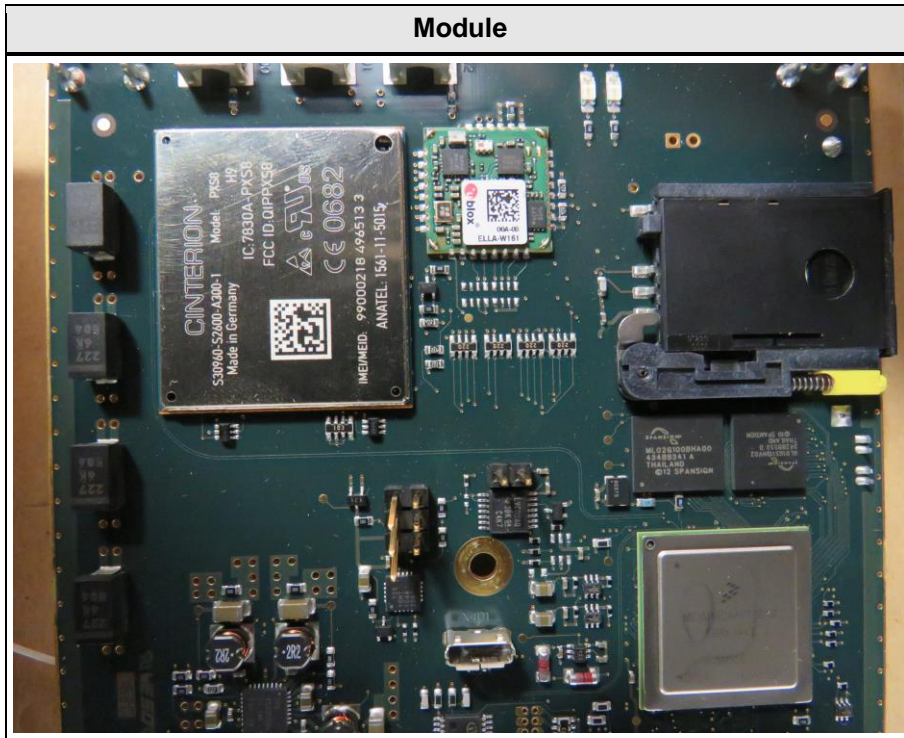




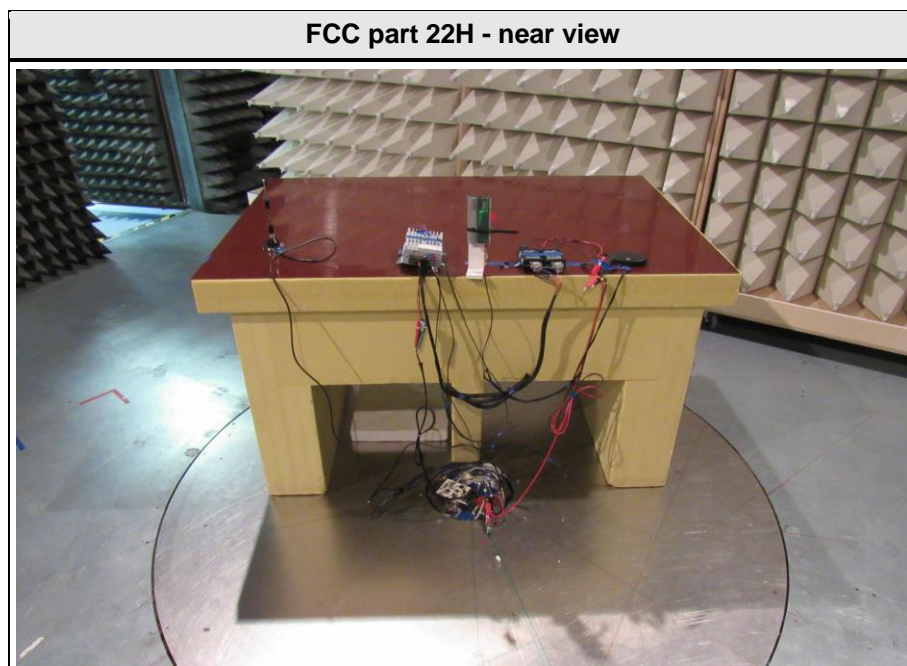
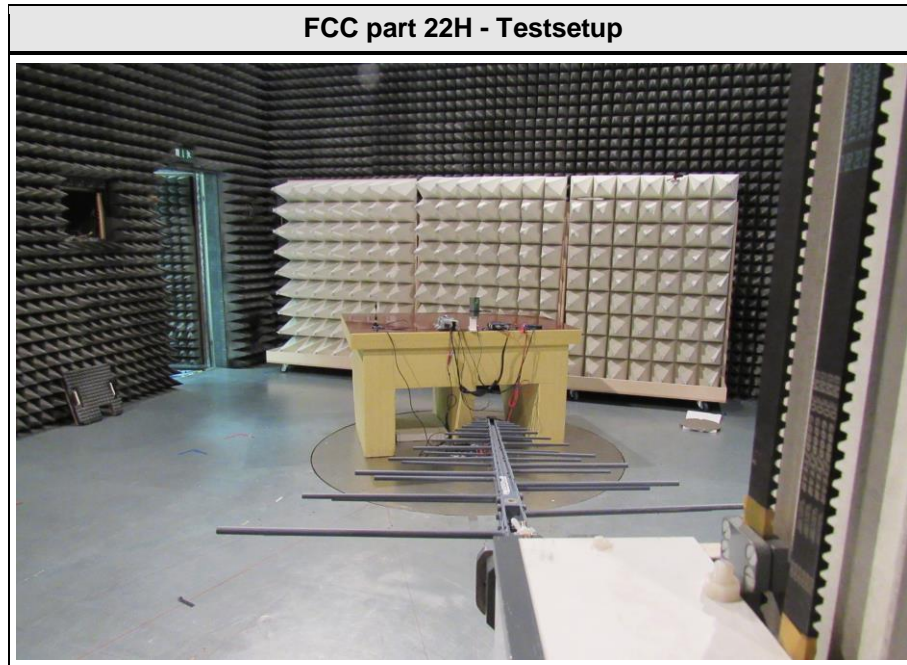
1.2 Photos – Equipment internal



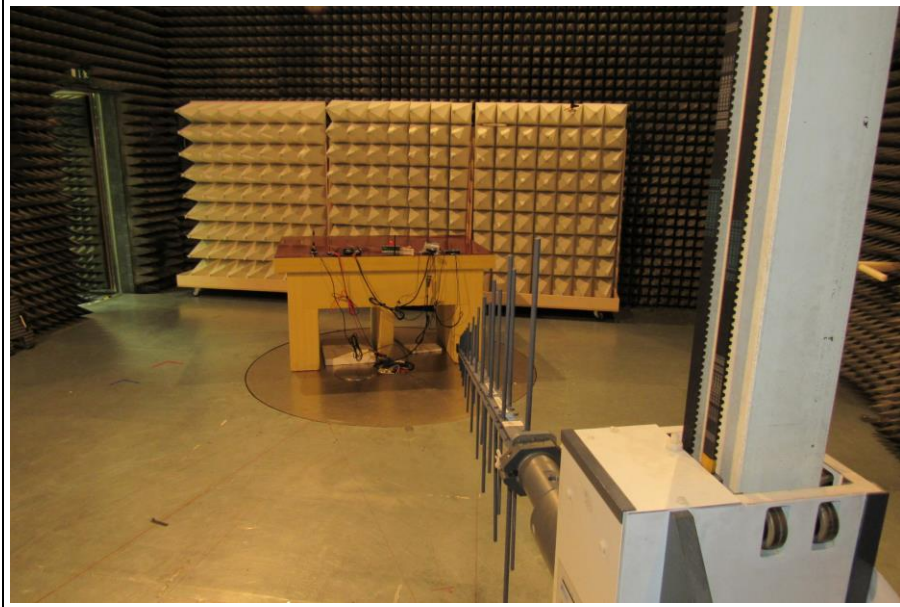
Module



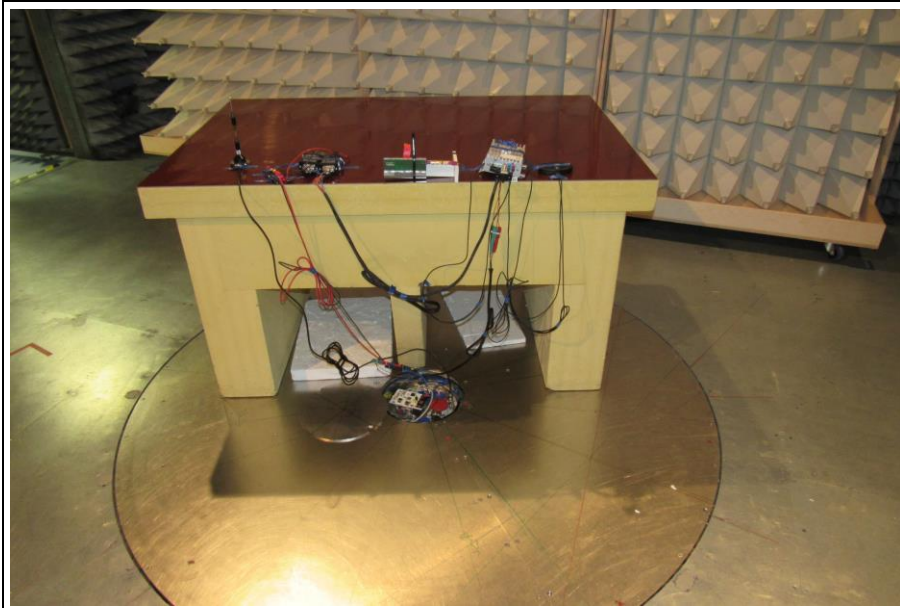
1.3 Photos – Test setup



FCC part 24E - Testsetup



FCC part 24E - near view



1.4 Supporting Equipment Used During Testing

Product Type	Device	Manufacturer	Model	Comment
SIM	Network	R&S	CMW500	GSM/UMTS -Tester
AE	WiFi-Antenna	Molex	5B4.035.510	Connected but not used
AE	CAN-Bus media-converter	Peak-System	PCAN-LWL	Connected and powered but not used
AE	GPS-Antenna	Hirschmann Car Communication	GPS 1890 LP P/series 920 061-305	Connected but not used
CBL	Power/CAN cable	---	1.80m	Connects EUT to power source and CAN-Bus
CBL	CAN-Powercable	---	2.0m	Powers CAN-Bus media converter
CBL	EUT-Powercable	---	1.0m	Powers EUT
CBL	GSM/UMTS Antenna-cable	---	2.0m RG-174	Connects GSM/UMTS antenna to EUT
Description:				
AE	Auxiliary Equipment			
SIM	Simulator			
CBL	Connecting Cable			
SFT	Software			
Comment: The Equipment Under Test used an operating system with a test firmware. The driver for IEEE 802.11 was running in a manufacturing mode.				

1.5 Test Modes

Mode #	Description	
GPRS	General conditions:	EUT powered by power supply. Mobile and GPS antenna connected. Active call to communication tester.
	Radio conditions:	Mode = transmit Connection = packet switched Modulation = GMSK Slot configuration = 1 up / 1 down Power level = Maximum (Gamma3)
EDGE850	General conditions:	EUT powered by power supplier. Mobile and GPS antenna connected. Active call to communication tester.
	Radio conditions:	Mode = transmit Connection = packet switched Modulation = 8-PSK Slot configuration = 1 up / 1 down Power level = Maximum (Gamma6)
EDGE1900	General conditions:	EUT powered by power supplier. Mobile and GPS antenna connected. Active call to communication tester.
	Radio conditions:	Mode = transmit Connection = packet switched Modulation = 8-PSK Slot configuration = 1 up / 1 down Power level = Maximum (Gamma5)
W-CDMA	General conditions:	EUT powered by power supplier. Mobile and GPS antenna connected. Active call to communication tester.
	Radio conditions:	Mode = transmit Connection = packet switched Modulation = QPSK Mode = RMC 12.2kpbs Power level = Maximum
GSM - Idle	General conditions:	EUT powered by power supplier. Mobile and GPS antenna connected. No Active call to communication tester.
	Radio conditions:	Mode = receive Connection = no (registered state) Modulation = GMSK Slot configuration = 1 up / 1 down
W-CDMA - Idle	General conditions:	EUT powered by power supplier. Mobile and GPS antenna connected. No Active call to communication tester.
	Radio conditions:	Mode = receive Connection = Cell-FACH mode Modulation = QPSK

1.6 Test Equipment Used During Testing

Measurement Software			
Description	Manufacturer	Name	Version
EMC Test Software	Dare Instruments	Radimation	2015.2.4

Occupied Bandwidth					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSIQ 26	EF00242	2018-07	2019-07

Radiated power					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Fully-anechoic chamber	Frankonia	AC 3	EF00199	-	-
Spectrum Analyzer	R&S	FSIQ 26	EF00242	2018-07	2019-07
LPD Antenna	R&S	HL 223	EF00187	2019-05	2022-05
Horn Antenna	R&S	BBHA 9120D	EF01153	2018-09	2019-09

Radiated spurious emissions					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Semi-anechoic chamber	Frankonia	AC 1	EF00062	-	-
EMI Receiver	Keysight Technologies	N9038A-526/WXP	EF01070	2018-08	2019-08
Biconical Antenna	R&S	HK 116	EF00186	2018-03	2020-03
LPD Antenna	R&S	HL 223	EF00202	2018-03	2020-03
Horn Antenna	R&S	BBHA 9120	EF01153	2018-09	2019-09
Horn Antenna	R&S	ATH18G40	EF01152	2018-10	2019-10

1.7 Sample emission level calculation

The following is a description of terms and a sample calculation, as appears in the radiated emissions data table. The numbers used in the calculation are for example only. There is no direct correlation to the specific data taken for the product described in this document:

Reading:

This is the reading obtained on the spectrum analyzer in dB μ V. Any external preamplifiers used are taken into account through internal analyzer settings.

A.F.:

This is the antenna factor for the receiving antenna. It is a conversion factor, which converts electric fields strengths to voltages, which can be measured directly on the spectrum analyzer. It is treated as a loss in dB. Cable losses have been included with the A.F. to simplify the calculations. The antenna factor is used in calculations as follows:

$$\text{Reading on Analyzer (dB}\mu\text{V)} + \text{A.F. (dB)} = \text{Net field strength (dB}\mu\text{V/m)}$$

Net:

This is the net field strength measurement (as shown above).

Limit:

This is the FCC Class B radiated emission limit (in units of dB μ V/m). The FCC limits are given in units of μ V/m. The following formula is used to convert the units of μ V/m to dB μ V/m:

$$\text{Limit (dB}\mu\text{V/m)} = 20 \cdot \log(\mu\text{V/m})$$

Margin:

This is the margin of compliance below the FCC limit. The units are given in dB. A negative margin indicates the emission was below the limit. A positive margin indicates that the emission exceeds the limit.

Example only:


$$\begin{array}{rclcl} \text{Reading} & + & \text{AF} & = & \text{Net Reading} & : & \text{Net reading} - \text{FCC limit} & = & \text{Margin} \\ 21.5 \text{ dB}\mu\text{V} & + & 26 \text{ dB} & = & 47.5 \text{ dB}\mu\text{V/m} & : & 47.5 \text{ dB}\mu\text{V/m} - 57.0 \text{ dB}\mu\text{V/m} & = & -9.5 \text{ dB} \end{array}$$

2 Result Summary

FCC 47 CFR Part 22H, 24E, ISED RSS-132, 133				
Product Specific Standard Section	Requirement – Test	Reference Method	Result	Remarks
RSS-Gen 6.6	Occupied Bandwidth	RSS-Gen 6.6 KDB 971168 ANSI C63.26-2015 5.4	PASS	Informational only
FCC § 24.235 FCC § 22.355 ISED RSS-132 § 4.3 ISED RSS-133 § 6.3	Frequency stability	FCC § 24.235 FCC § 22.355 ISED RSS-132 § 4.3 ISED RSS-133 § 6.3 KDB 971168 ANSI C63.26-2015 5.6	N/T	
FCC § 22.913(a)	Effective radiated power	ANSI C63.26-2015 KDB 971168	PASS	
FCC § 24.232(c) ISED RSS-132 § 4.4 ISED RSS-133 § 6.4	Equivalent isotropic radiated power	KDB 971168 ANSI C63.26-2015 5.2	PASS	
FCC § 24.232(d) ISED RSS-133 § 6.4	Peak to average ratio	KDB 971168	N/T	
FCC § 22.917(b) FCC § 24.238(b) ISED RSS-132 § 4.5 ISED RSS-133 § 6.5	Band-edge compliance	KDB 971168	N/T	
FCC § 22.917(a) FCC § 24.238(a) ISED RSS-132 § 4.5 ISED RSS-133 § 6.5	Conducted out-of-band emissions	KDB 971168 ANSI C63.26-2015 5.7	N/T	
FCC § 22.917(a) FCC § 24.238(a) ISED RSS-132 § 4.5 ISED RSS-133 § 6.5	Radiated out-of-band emissions	KDB 971168 ANSI C63.26-2015 5.5	PASS	
ISED RSS-132 § 4.6 ISED RSS-133 § 6.6 ISED RSS-Gen 7.1	Receiver radiated spurious emissions	ISED RSS-Gen 7.1 ANSI C63.4	PASS	
Remarks:				

3 Test Conditions and Results

3.1 Test Conditions and Results – Occupied Bandwidth

Occupied Bandwidth acc. to ISED RSS-Gen			
Test according to measurement reference	Reference Method		
	RSS-Gen 6.6 / KDB 971168 / ANSI C63.26-2015 5.4		
Test frequency range	Tested frequencies		
	$F_{LOW} / F_{MID} / F_{HIGH}$		
Limits			
None (Informational only)			
Test setup			
 <pre> graph LR SA[Spectrum Analyzer] --- EUT[EUT] </pre>			
Test procedure			
<ol style="list-style-type: none"> 1. EUT set to test mode (Communication tester is used if needed) 2. Span set to at least twice the emission spectrum 3. Resolution bandwidth set to 1 % of span 4. Occupied Bandwidth (99 %) measurement with spectrum analyzer built in measurement function 			
Test results – GSM850			
Channel	Frequency [MHz]	Mode	Occupied Bandwidth [kHz]
F_{LOW}	824.2	GPRS	248.0
F_{MID}	836.2	GPRS	246.0
F_{HIGH}	848.8	GPRS	250.0
F_{LOW}	824.2	EDGE850	250.0
F_{MID}	836.2	EDGE850	248.0
F_{HIGH}	848.8	EDGE850	248.0

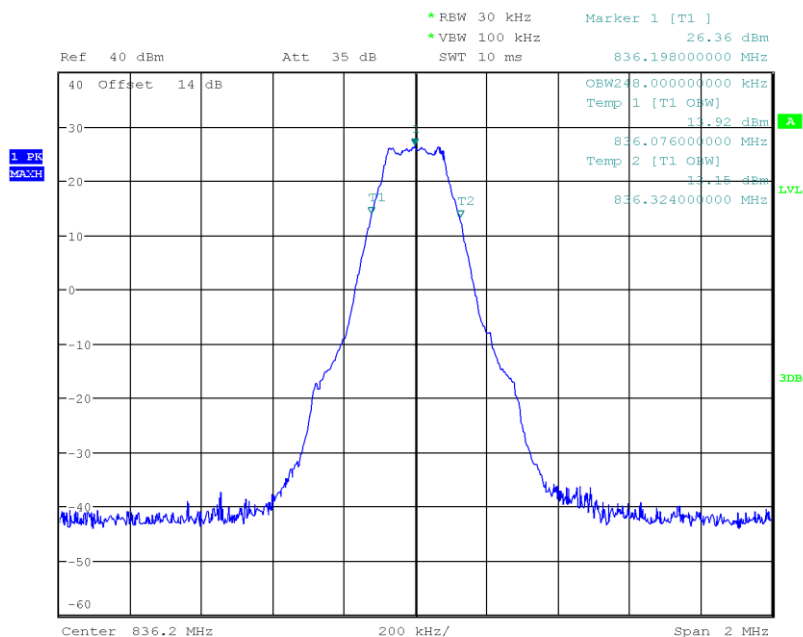
Test results – GSM1900			
Channel	Frequency [MHz]	Mode	Occupied Bandwidth [kHz]
F _{LOW}	1850.2	GPRS	250.0
F _{MID}	1880	GPRS	250.0
F _{HIGH}	1909.8	GPRS	252.0
F _{LOW}	1850.2	EDGE1900	254.0
F _{MID}	1880	EDGE1900	252.0
F _{HIGH}	1909.8	EDGE1900	250.0
Comments:			

Test results – W-CDMA FDD V			
Channel	Frequency [MHz]	Mode	Occupied Bandwidth [kHz]
F _{LOW}	826.6	W-CDMA	4140
F _{MID}	835.0	W-CDMA	4140
F _{HIGH}	846.4	W-CDMA	4170
Comments:			

Test results – W-CDMA FDD II			
Channel	Frequency [MHz]	Mode	Occupied Bandwidth [kHz]
F _{LOW}	1852.6	W-CDMA	4160
F _{MID}	1880.0	W-CDMA	4160
F _{HIGH}	1907.4	W-CDMA	4160
Comments:			

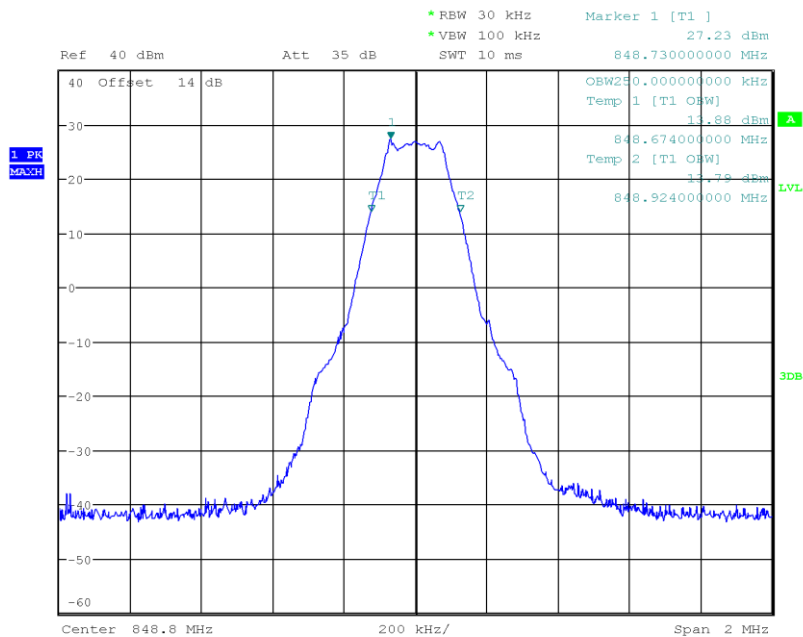
Occupied Bandwidth – GPRS 850 - F_{MID}
Occupied Bandwidth

Project Number: G0M-1901-8021
 Applicant: IAV GmbH
 Model Description: Telemetry Equipment
 Model: TDBOX2
 Test Sample ID: 22749
 Reference Standards: RSS-Gen
 Reference Method: ANSI C63.26:2015, Section 5.4.4
 Operating Frequency: 836.2 MHz
 Operating Conditions: Tnom/Vnom
 Operator: Burkhard Pudell
 Test Site: Eurofins Product Service GmbH
 Test Date: 2019-02-20
 Note: GPRS 850_Channel 188
 Occupied Bandwidth [kHz]: 246.0



Occupied Bandwidth – GPRS 850 - F_{HIGH}
Occupied Bandwidth

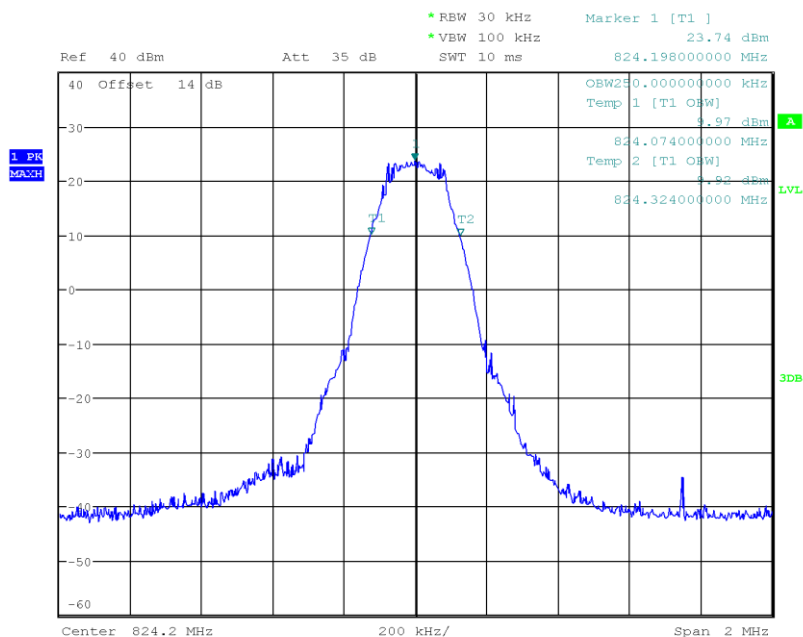
Project Number: G0M-1901-8021
 Applicant: IAV GmbH
 Model Description: Telemetry Equipment
 Model: TDBOX2
 Test Sample ID: 22749
 Reference Standards: RSS-Gen
 Reference Method: ANSI C63.26:2015, Section 5.4.4
 Operating Frequency: 848.8 MHz
 Operating Conditions: Tnom/Vnom
 Operator: Burkhard Pudell
 Test Site: Eurofins Product Service GmbH
 Test Date: 2019-02-20
 Note: GPRS 850_Channel 251
 Occupied Bandwidth [kHz]: 250.0



Date: 20.FEB.2019 09:25:58

Occupied Bandwidth – EDGE 850 - F_{Low}
Occupied Bandwidth

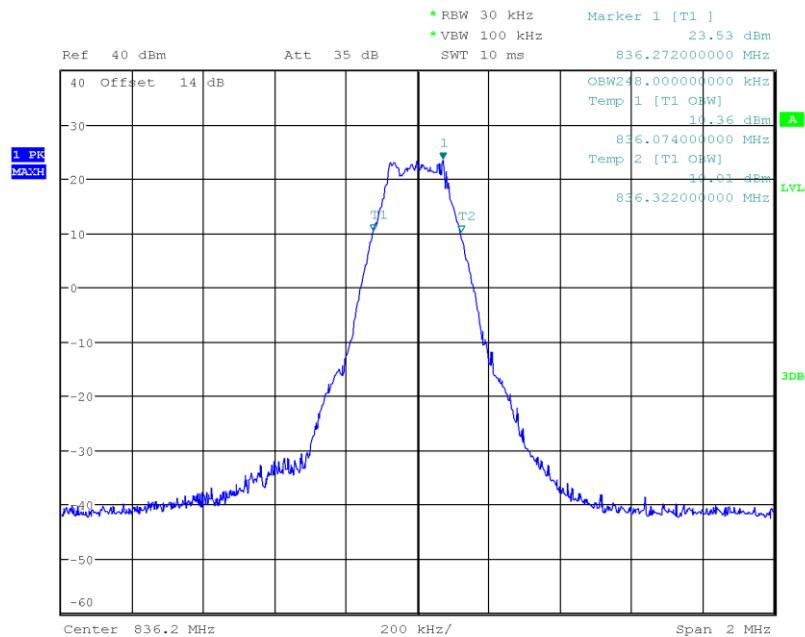
Project Number: G0M-1901-8021
 Applicant: IAV GmbH
 Model Description: Telemetry Equipment
 Model: TDBOX2
 Test Sample ID: 22749
 Reference Standards: RSS-Gen
 Reference Method: ANSI C63.26:2015, Section 5.4.4
 Operating Frequency: 824.2 MHz
 Operating Conditions: Tnom/Vnom
 Operator: Burkhard Pudell
 Test Site: Eurofins Product Service GmbH
 Test Date: 2019-02-20
 Note: EDGE 850_Channel 128
 Occupied Bandwidth [kHz]: 250.0



Date: 20.FEB.2019 10:13:14

Occupied Bandwidth – EDGE 850 - F_{MB}
Occupied Bandwidth

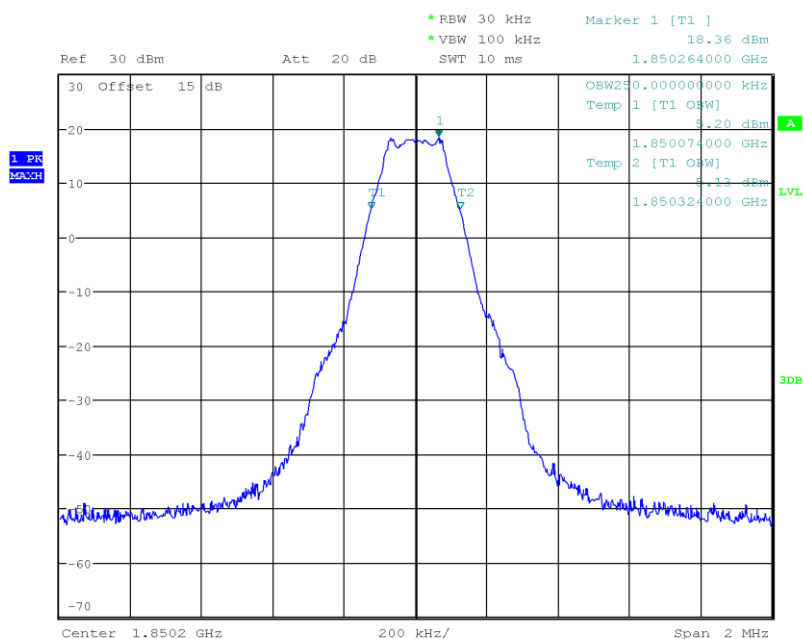
Project Number: G0M-1901-8021
 Applicant: IAV GmbH
 Model Description: Telemetry Equipment
 Model: TDBOX2
 Test Sample ID: 22749
 Reference Standards: RSS-Gen
 Reference Method: ANSI C63.26:2015, Section 5.4.4
 Operating Frequency: 836.2 MHz
 Operating Conditions: Tnom/Vnom
 Operator: Burkhard Pudell
 Test Site: Eurofins Product Service GmbH
 Test Date: 2019-02-20
 Note: EDGE 850_Channel 188
 Occupied Bandwidth [kHz]: 248.0



Date: 20.FEB.2019 10:07:20

Occupied Bandwidth – GPRS1900 - F_{Low}
Occupied Bandwidth

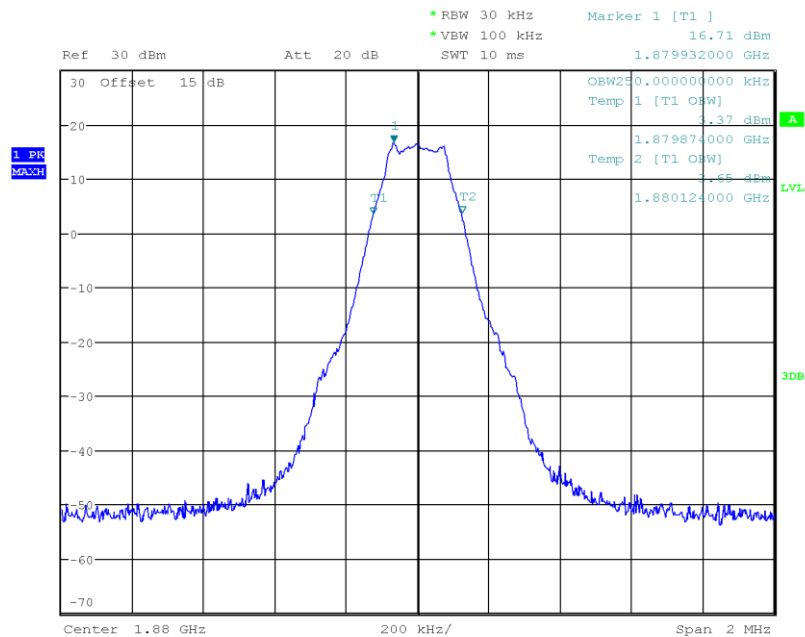
Project Number: G0M-1901-8021
 Applicant: IAV GmbH
 Model Description: Telemetry Equipment
 Model: TDBOX2
 Test Sample ID: 22749
 Reference Standards: RSS-Gen
 Reference Method: ANSI C63.26:2015, Section 5.4.4
 Operating Frequency: 1850.2 MHz
 Operating Conditions: Tnom/Vnom
 Operator: Burkhard Pudell
 Test Site: Eurofins Product Service GmbH
 Test Date: 2019-02-27
 Note: GPRS 1900_Channel 512
 Occupied Bandwidth [kHz]: 250.0



Date: 27.FEB.2019 10:41:21

Occupied Bandwidth – GPRS1900 - F_{MD}
Occupied Bandwidth

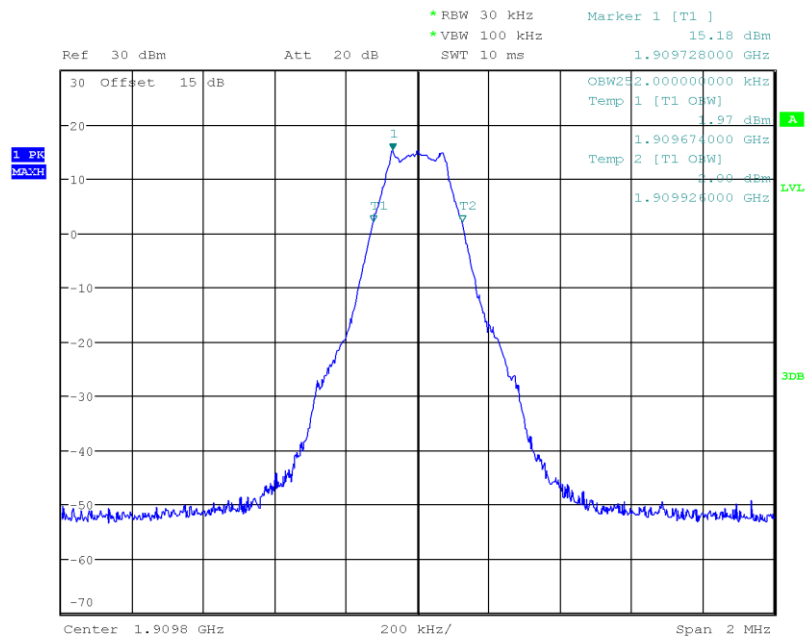
Project Number: G0M-1901-8021
 Applicant: IAV GmbH
 Model Description: Telemetry Equipment
 Model: TDBOX2
 Test Sample ID: 22749
 Reference Standards: RSS-Gen
 Reference Method: ANSI C63.26:2015, Section 5.4.4
 Operating Frequency: 1880.0 MHz
 Operating Conditions: Tnom/Vnom
 Operator: Burkhard Pudell
 Test Site: Eurofins Product Service GmbH
 Test Date: 2019-02-27
 Note: GPRS 1900_Channel 661
 Occupied Bandwidth [kHz]: 250.0



Date: 27.FEB.2019 10:44:41

Occupied Bandwidth – GPRS1900 - F_{HIGH}
Occupied Bandwidth

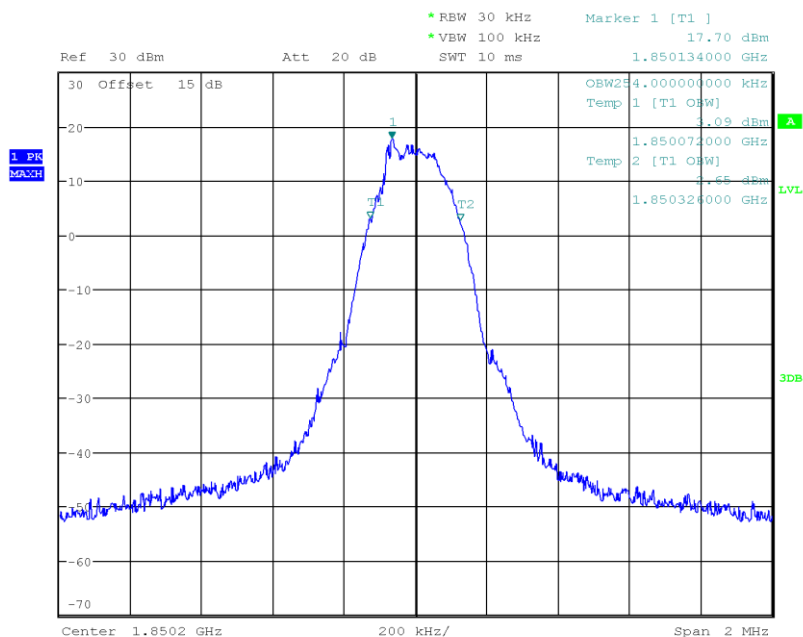
Project Number: G0M-1901-8021
 Applicant: IAV GmbH
 Model Description: Telemetry Equipment
 Model: TDBOX2
 Test Sample ID: 22749
 Reference Standards: RSS-Gen
 Reference Method: ANSI C63.26:2015, Section 5.4.4
 Operating Frequency: 1909.8 MHz
 Operating Conditions: Tnom/Vnom
 Operator: Burkhard Pudell
 Test Site: Eurofins Product Service GmbH
 Test Date: 2019-02-27
 Note: GPRS 1900_Channel 810
 Occupied Bandwidth [kHz]: 252.0



Date: 27.FEB.2019 10:47:28

Occupied Bandwidth – EDGE1900 - F_{Low}
Occupied Bandwidth

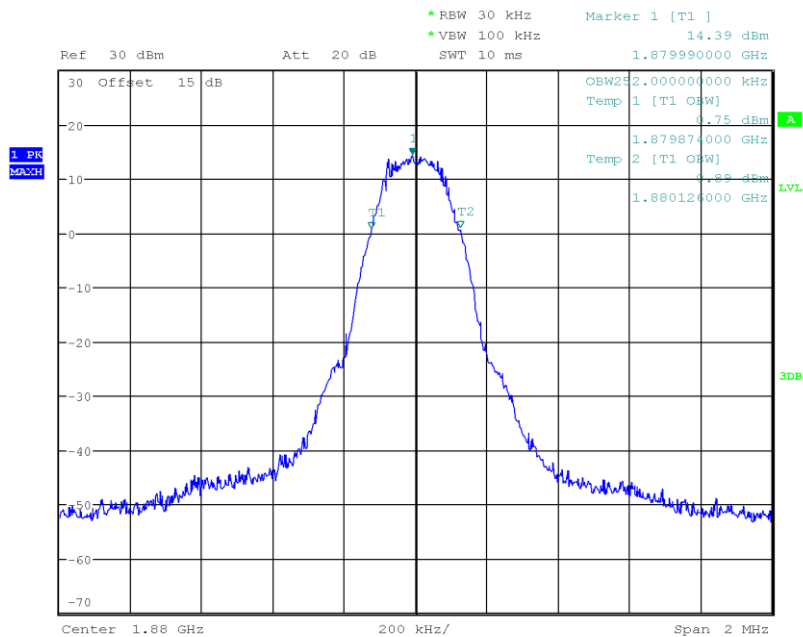
Project Number: G0M-1901-8021
 Applicant: IAV GmbH
 Model Description: Telemetry Equipment
 Model: TDBOX2
 Test Sample ID: 22749
 Reference Standards: RSS-Gen
 Reference Method: ANSI C63.26:2015, Section 5.4.4
 Operating Frequency: 1850.2 MHz
 Operating Conditions: Tnom/Vnom
 Operator: Burkhard Pudell
 Test Site: Eurofins Product Service GmbH
 Test Date: 2019-02-27
 Note: EDGE 1900_Channel 512
 Occupied Bandwidth [kHz]: 254.0



Date: 27.FEB.2019 10:36:49

Occupied Bandwidth – EDGE1900 - F_{MD}
Occupied Bandwidth

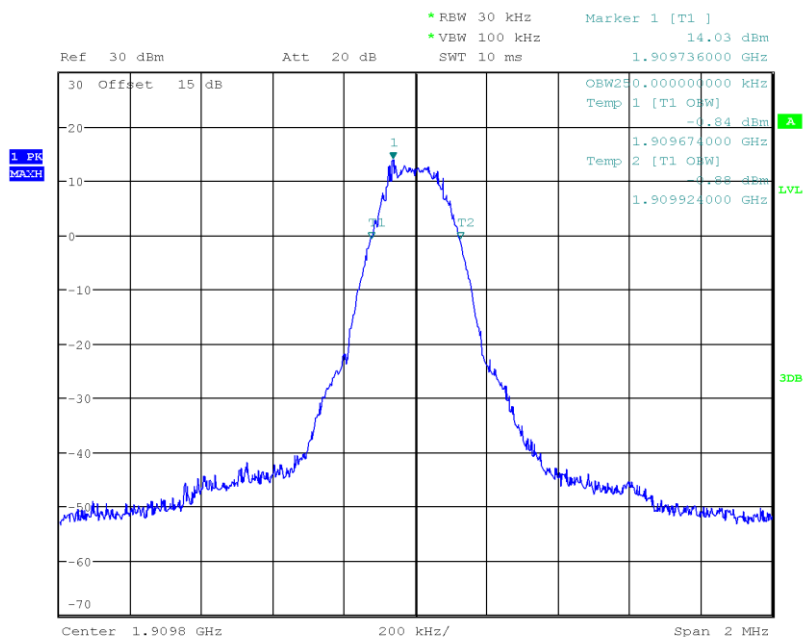
Project Number: G0M-1901-8021
 Applicant: IAV GmbH
 Model Description: Telemetry Equipment
 Model: TDBOX2
 Test Sample ID: 22749
 Reference Standards: RSS-Gen
 Reference Method: ANSI C63.26:2015, Section 5.4.4
 Operating Frequency: 1880.0 MHz
 Operating Conditions: Tnom/Vnom
 Operator: Burkhard Pudell
 Test Site: Eurofins Product Service GmbH
 Test Date: 2019-02-27
 Note: EDGE 1900_Channel 661
 Occupied Bandwidth [kHz]: 252.0



Date: 27.FEB.2019 10:34:27

Occupied Bandwidth – EDGE1900 - F_{HIGH}
Occupied Bandwidth

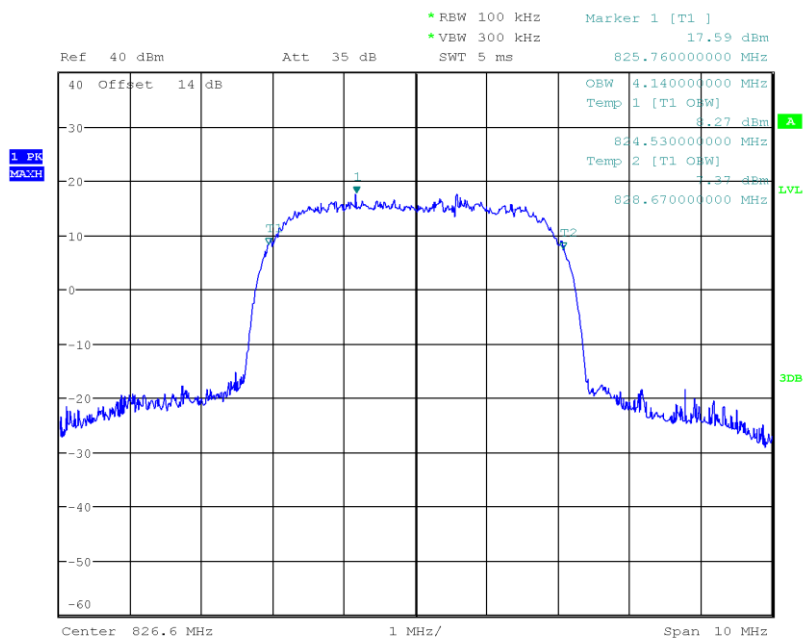
Project Number: G0M-1901-8021
 Applicant: IAV GmbH
 Model Description: Telemetry Equipment
 Model: TDBOX2
 Test Sample ID: 22749
 Reference Standards: RSS-Gen
 Reference Method: ANSI C63.26:2015, Section 5.4.4
 Operating Frequency: 1909.8 MHz
 Operating Conditions: Tnom/Vnom
 Operator: Burkhard Pudell
 Test Site: Eurofins Product Service GmbH
 Test Date: 2019-02-27
 Note: EDGE 1900_Channel 810
 Occupied Bandwidth [kHz]: 250.0



Date: 27.FEB.2019 10:28:29

Occupied Bandwidth – W-CDMA FDD V - F_{Low}
Occupied Bandwidth

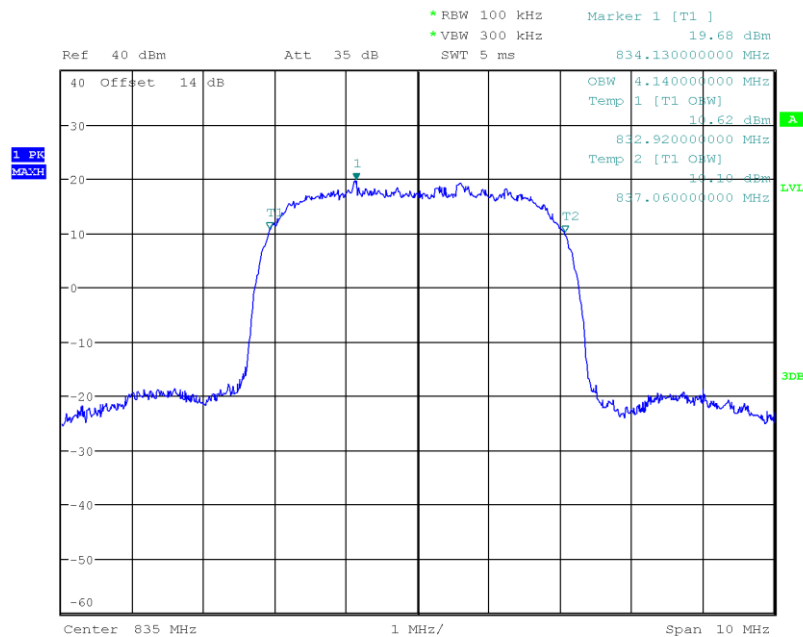
Project Number: G0M-1901-8021
 Applicant: IAV GmbH
 Model Description: Telemetry Equipment
 Model: TDBOX2
 Test Sample ID: 22749
 Reference Standards: RSS-Gen
 Reference Method: ANSI C63.26:2015, Section 5.4.4
 Operating Frequency: 826.6 MHz
 Operating Conditions: Tnom/Vnom
 Operator: Burkhard Pudell
 Test Site: Eurofins Product Service GmbH
 Test Date: 2019-02-20
 Note: UMTS FDD V_CH: 4133; RMC; QPSK
 Occupied Bandwidth [kHz]: 4140.0



Date: 20.FEB.2019 11:28:45

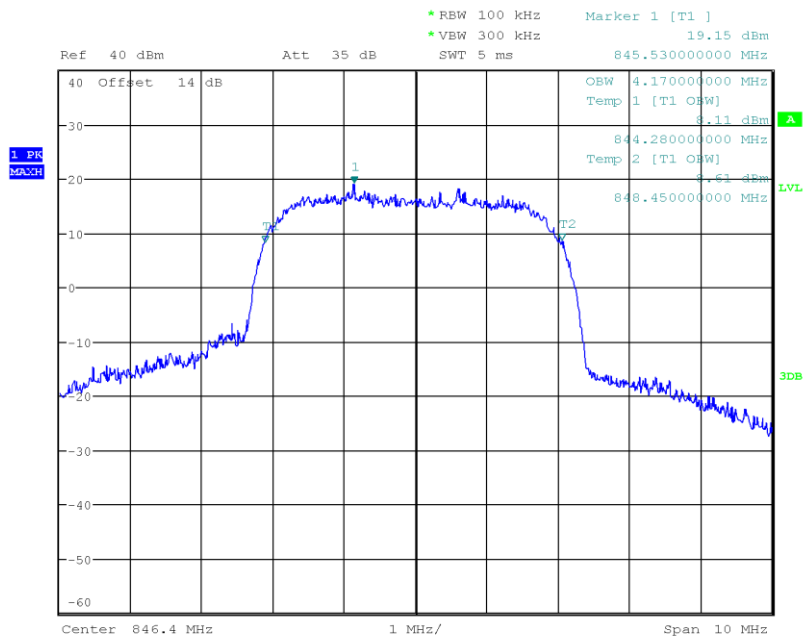
Occupied Bandwidth – W-CDMA FDD V - F_{MID}
Occupied Bandwidth

Project Number: G0M-1901-8021
 Applicant: IAV GmbH
 Model Description: Telemetry Equipment
 Model: TDBOX2
 Test Sample ID: 22749
 Reference Standards: RSS-Gen
 Reference Method: ANSI C63.26:2015, Section 5.4.4
 Operating Frequency: 835.0 MHz
 Operating Conditions: Tnom/Vnom
 Operator: Burkhard Pudell
 Test Site: Eurofins Product Service GmbH
 Test Date: 2019-02-20
 Note: UMTS FDD V_CH: 4175; RMC; QPSK
 Occupied Bandwidth [kHz]: 4140.0



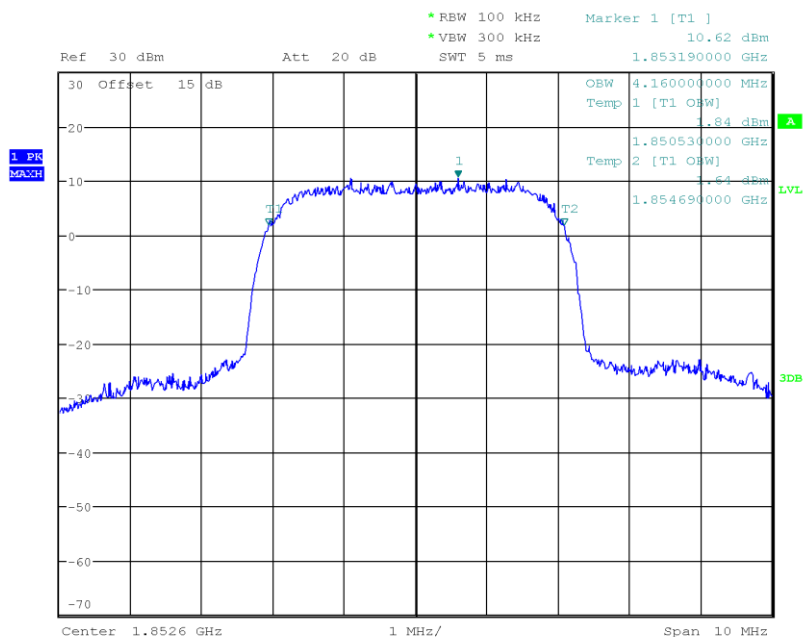
Occupied Bandwidth – W-CDMA FDD V - F_{HIGH}
Occupied Bandwidth

Project Number: G0M-1901-8021
 Applicant: IAV GmbH
 Model Description: Telemetry Equipment
 Model: TDBOX2
 Test Sample ID: 22749
 Reference Standards: RSS-Gen
 Reference Method: ANSI C63.26:2015, Section 5.4.4
 Operating Frequency: 846.4 MHz
 Operating Conditions: Tnom/Vnom
 Operator: Burkhard Pudell
 Test Site: Eurofins Product Service GmbH
 Test Date: 2019-02-20
 Note: UMTS FDD V_CH: 4232; RMC; QPSK
 Occupied Bandwidth [kHz]: 4170.0



Occupied Bandwidth – W-CDMA FDD II - F_{Low}
Occupied Bandwidth

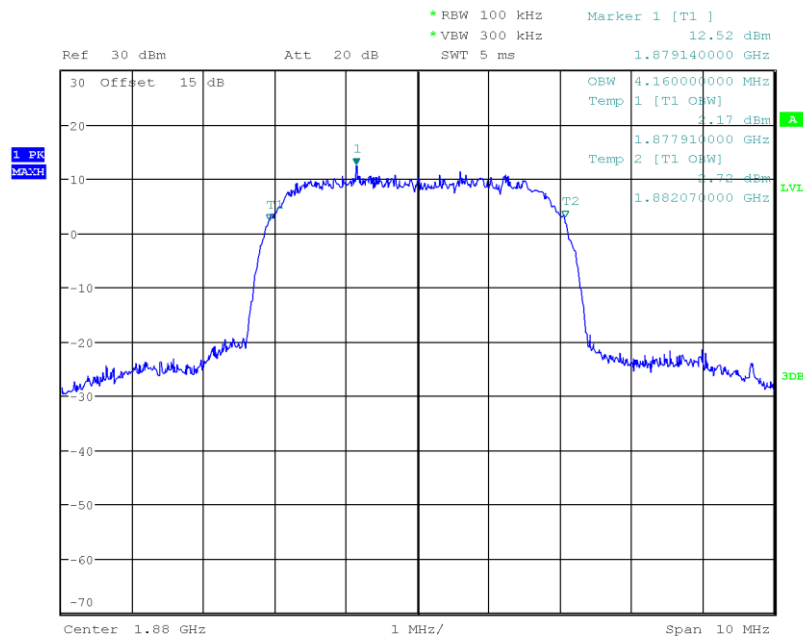
Project Number: G0M-1901-8021
 Applicant: IAV GmbH
 Model Description: Telemetry Equipment
 Model: TDBOX2
 Test Sample ID: 22749
 Reference Standards: RSS-Gen
 Reference Method: ANSI C63.26:2015, Section 5.4.4
 Operating Frequency: 1852.6 MHz
 Operating Conditions: Tnom/Vnom
 Operator: Burkhard Pudell
 Test Site: Eurofins Product Service GmbH
 Test Date: 2019-02-20
 Note: UMTS FDD II_CH: 9263; RMC; QPSK
 Occupied Bandwidth [kHz]: 4160.0



Date: 20.FEB.2019 14:18:36

Occupied Bandwidth – W-CDMA FDD II - F_{MD}
Occupied Bandwidth

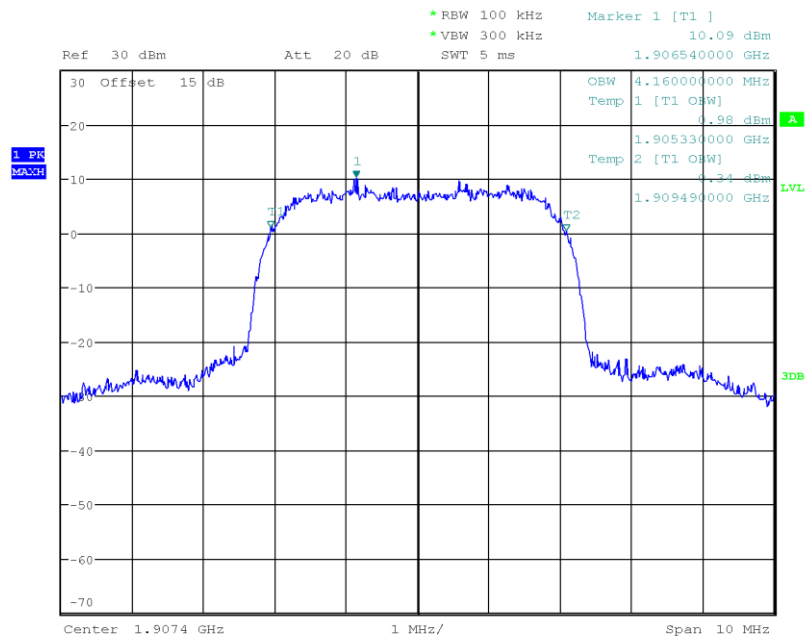
Project Number: G0M-1901-8021
 Applicant: IAV GmbH
 Model Description: Telemetry Equipment
 Model: TDBOX2
 Test Sample ID: 22749
 Reference Standards: RSS-Gen
 Reference Method: ANSI C63.26:2015, Section 5.4.4
 Operating Frequency: 1880.0 MHz
 Operating Conditions: Tnom/Vnom
 Operator: Burkhard Pudell
 Test Site: Eurofins Product Service GmbH
 Test Date: 2019-02-20
 Note: UMTS FDD II_CH: 9400; RMC; QPSK
 Occupied Bandwidth [kHz]: 4160.0



Date: 20.FEB.2019 14:15:05

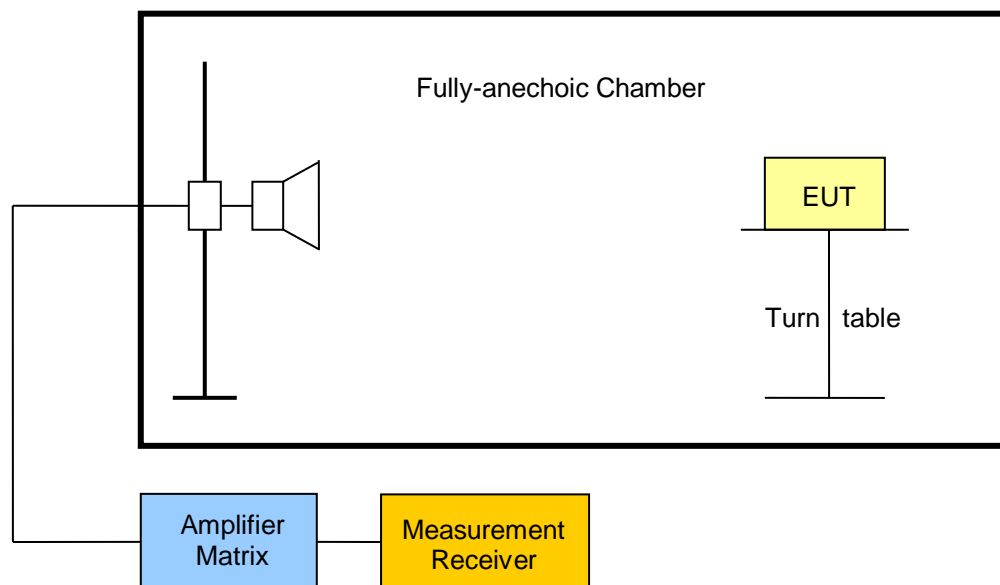
Occupied Bandwidth – W-CDMA FDD II - F_{HIGH}
Occupied Bandwidth

Project Number: G0M-1901-8021
 Applicant: IAV GmbH
 Model Description: Telemetry Equipment
 Model: TDBOX2
 Test Sample ID: 22749
 Reference Standards: RSS-Gen
 Reference Method: ANSI C63.26:2015, Section 5.4.4
 Operating Frequency: 1907.4 MHz
 Operating Conditions: Tnom/Vnom
 Operator: Burkhard Pudell
 Test Site: Eurofins Product Service GmbH
 Test Date: 2019-02-20
 Note: UMTS FDD II_CH: 9263; RMC; QPSK
 Occupied Bandwidth [kHz]: 4160.0



Date: 20.FEB.2019 14:21:05

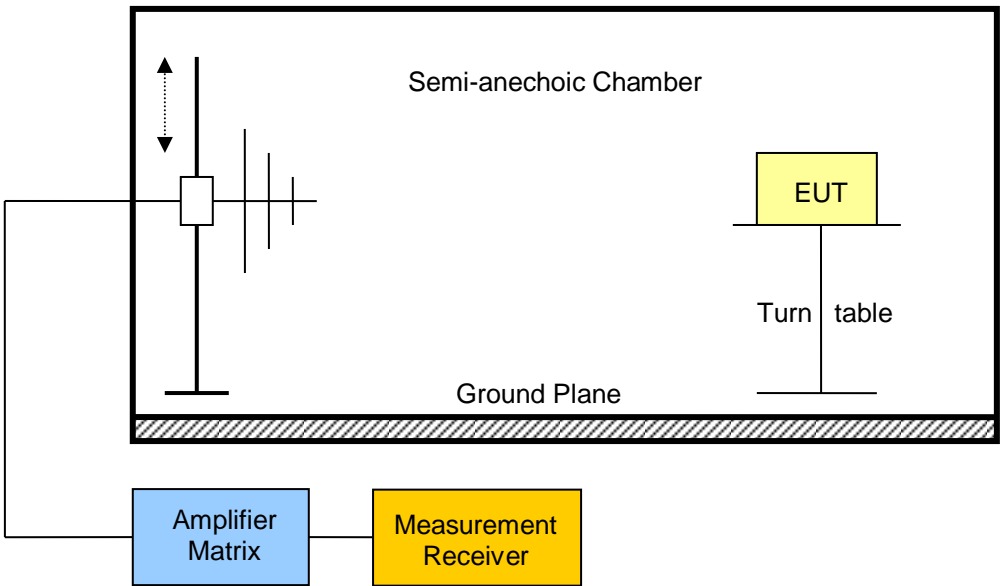
3.2 Test Conditions and Results – Effective radiated power / Equivalent isotropic radiated power

Radiated power acc. to FCC 22H / FCC 24E / ISED RSS-132 / ISED RSS-133		Verdict: PASS
EUT requirement rule parts and clause	Reference	
	FCC § 22.913(a) / FCC § 24.232(c) ISED RSS-132 § 4.4 / IC RSS-133 § 6.4	
Test according to measurement reference	Reference Method	
	FCC § 22.913(a) / FCC § 24.232(c) / ISED RSS-132 § 4.4 / ISED RSS-133 § 6.4 / ANSI C63.26-2015 5.2	
Test frequency range	Tested frequencies	
	$F_{LOW} / F_{MID} / F_{HIGH}$	
Limits		
Carrier Frequency range	Equipment type	Power limit
824-849 MHz	Mobile transmitter	FCC : 7 Watts (38.45 dBm) e.i.r.p. ISED : 11.5 Watts (40.60 dBm) e.i.r.p.
1850-1910 MHz	Mobile transmitter	FCC : 2 Watts (33 dBm) e.i.r.p. ISED : 2 Watts (33 dBm) e.i.r.p.
Test setup		
 <p>The diagram illustrates the test setup within a Fully-anechoic Chamber. On the left, a measurement antenna (dipole) is mounted on a vertical stand. On the right, the EUT (Equivalent Under Test) is placed on a turn table. The EUT is connected to an Amplifier Matrix and a Measurement Receiver located outside the chamber. The Amplifier Matrix is connected to the Measurement Receiver, and the EUT is connected to the Amplifier Matrix.</p>		
Test procedure		
<ol style="list-style-type: none"> 1. EUT set to test mode 2. The radiated power is measured with a measurement antenna in vertical polarization 3. To obtain maximum level the EUT is rotated 4. The EUT is replaced with a half-wave dipole and the power to the dipole is adjusted to obtain same radiated power measurement value 		

Test results – GSM850 E.R.P.							
Channel	Frequency [MHz]	Mode	Pol.	Power [dBm e.r.p]	Limit [dBm e.r.p]	Margin [dB]	Result
F _{LOW}	824.2	GPRS	hor	29.2	38.45	-09.25	PASS
F _{MID}	836.2	GPRS	hor	28.3	38.45	-10.15	PASS
F _{HIGH}	848.8	GPRS	hor	27.7	38.45	-10.75	PASS
F _{LOW}	824.2	EDGE850	hor	24.3	38.45	-14.15	PASS
F _{MID}	836.2	EDGE850	hor	24.6	38.45	-13.85	PASS
F _{HIGH}	848.8	EDGE850	hor	23.0	38.45	-15.45	PASS
Test results – W-CDMA FDD V E.R.P.							
Channel	Frequency [MHz]	Mode	Pol.	Power [dBm e.r.p]	Limit [dBm e.r.p]	Margin [dB]	Result
F _{LOW}	826.6	W-CDMA	hor	26.9	38.45	-11.55	PASS
F _{MID}	835.0	W-CDMA	hor	25.0	38.45	-13.45	PASS
F _{HIGH}	846.4	W-CDMA	hor	24.6	38.45	-13.85	PASS
Test results – GSM850 E.I.R.P.							
Channel	Frequency [MHz]	Mode	Pol.	Power [dBm e.i.r.p]	Limit [dBm e.i.r.p]	Margin [dB]	Result
F _{LOW}	824.2	GPRS	hor	31.4	40.6	-09.20	PASS
F _{MID}	836.2	GPRS	hor	30.5	40.6	-10.10	PASS
F _{HIGH}	848.8	GPRS	hor	29.9	40.6	-10.70	PASS
F _{LOW}	824.2	EDGE850	hor	26.5	40.6	-14.10	PASS
F _{MID}	836.2	EDGE850	hor	26.8	40.6	-13.80	PASS
F _{HIGH}	848.8	EDGE850	hor	25.2	40.6	-15.40	PASS
Test results – W-CDMA FDD V E.I.R.P.							
Channel	Frequency [MHz]	Mode	Pol.	Power [dBm e.i.r.p]	Limit [dBm e.i.r.p]	Margin [dB]	Result
F _{LOW}	826.6	W-CDMA	hor	29.1	40.6	-11.50	PASS
F _{MID}	835.0	W-CDMA	hor	27.2	40.6	-13.40	PASS
F _{HIGH}	846.4	W-CDMA	hor	26.8	40.6	-13.80	PASS

Test results – GSM1900 E.I.R.P.							
Channel	Frequency [MHz]	Mode	Pol.	Power [dBm e.i.r.p]	Limit [dBm e.i.r.p]	Margin [dB]	Result
F _{LOW}	1850.2	GPRS	hor	16.2	33	-16.80	PASS
F _{MID}	1880.0	GPRS	hor	17.9	33	-15.10	PASS
F _{HIGH}	1909.8	GPRS	hor	17.3	33	-15.70	PASS
F _{LOW}	1850.2	EDGE1900	hor	13.6	33	-19.40	PASS
F _{MID}	1880.0	EDGE1900	hor	12.8	33	-20.20	PASS
F _{HIGH}	1909.8	EDGE1900	hor	13.9	33	-19.10	PASS
Test results – UMTS FDD II E.I.R.P.							
Channel	Frequency [MHz]	Mode	Pol.	Power [dBm e.i.r.p]	Limit [dBm e.i.r.p]	Margin [dB]	Result
F _{LOW}	1852.6	W-CDMA	hor	17.3	33	-15.70	PASS
F _{MID}	1880.0	W-CDMA	hor	18.0	33	-15.00	PASS
F _{HIGH}	1907.4	W-CDMA	hor	17.3	33	-15.70	PASS
Comments:							

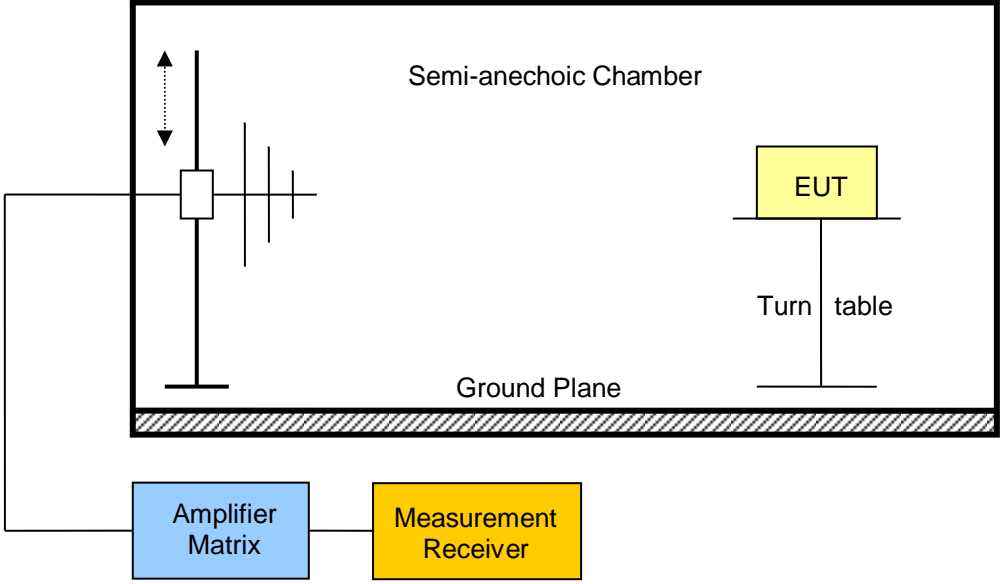
3.3 Test Conditions and Results – Transmitter radiated emissions

Transmitter radiated power acc. to FCC 22H / FCC 24E / ISED RSS-132 / ISED RSS-133		Verdict: PASS
Test according referenced standards	Reference Method	
	FCC § 22.917(a) / FCC § 24.238(a) ISED RSS-132 § 4.5 / ISED RSS-133 § 6.5	
Test according to measurement reference	Reference Method	
	ANSI C63.26-2015 5.5	
Test frequency range	Tested frequencies	
	30 MHz – 10 th Harmonic	
Limits		
Carrier Frequency range	Limit	
824-849 MHz	Attenuation below transmitter power $\geq 43 + 10 \cdot \log_{10}(P)$ [dB] = -13 dBm	
1850-1910 MHz	Attenuation below transmitter power $\geq 43 + 10 \cdot \log_{10}(P)$ [dB] = -13 dBm	
Test setup		
		
Test procedure		
<ol style="list-style-type: none"> 1. EUT set to test mode 2. Maximum emission level is measured by rotating the EUT and adjusting the antenna height for vertical polarization 3. The EUT is replaced by a substitution antenna and generator 4. The power level is set to obtain the same power reading 5. Measurement is repeated for horizontal polarization 		

Test results – FCC 22H							
Channel	Frequency [MHz]	Mode	Emission [MHz]	Level [dbm]	Pol.	Limit [dBm]	Margin [dB]
F _{LOW}	824.2	GPRS	1642	-51.42	ver	-13	-38.42
F _{LOW}	824.2	GPRS	1648	-47.71	hor	-13	-34.71
F _{LOW}	824.2	EDGE850	1642	-53.73	ver	-13	-40.73
F _{LOW}	824.2	EDGE850	1648	-48.18	hor	-13	-35.18
F _{MID}	836.2	GPRS	1672	-51.82	ver	-13	-38.82
F _{HIGH}	848.8	GPRS	1696	-47.12	hor	-13	-34.12
F _{HIGH}	848.8	GPRS	1696	-48.86	ver	-13	-35.86
F _{LOW}	824.2	GPRS	3094	-44.33	hor	-13	-31.33
F _{HIGH}	848.8	EDGE850	1696	-53.27	ver	-13	-40.27
F _{MID}	836.2	EDGE850	5144	-49.41	ver	-13	-36.41
F _{MID}	836.2	EDGE850	6520	-47.93	hor	-13	-34.93
F _{HIGH}	848.8	EDGE850	3694	-51.54	ver	-13	-38.54
F _{LOW}	826.6	W-CDMA	3118	-44.46	hor	-13	-31.46
F _{LOW}	826.6	W-CDMA	7208	-45.03	hor	-13	-32.03
F _{MID}	835.0	W-CDMA	10970	-51.16	ver	-13	-38.16
F _{MID}	835.0	W-CDMA	2878	-44.42	hor	-13	-31.42
F _{HIGH}	846.4	W-CDMA	5480	-50.13	ver	-13	-37.13
F _{HIGH}	846.4	W-CDMA	10205	-51.96	hor	-13	-38.96
Comments: Transmitter does not support HSUPA (customer declaration)							

Test results – FCC 24E							
Channel	Frequency [MHz]	Mode	Emission [MHz]	Level [dbm]	Pol.	Limit [dBm]	Margin [dB]
F _{LOW}	1852.6	W-CDMA	1847	-20.96	hor	-13	-07.96
F _{LOW}	1852.6	W-CDMA	1847	-18.3	ver	-13	-05.30
F _{HIGH}	1907.4	W-CDMA	1911	-17.1	ver	-13	-04.10
F _{HIGH}	1907.4	W-CDMA	1912	-16.94	hor	-13	-03.94
F _{HIGH}	1907.4	W-CDMA	1983	-27.35	hor	-13	-14.35
F _{HIGH}	1907.4	W-CDMA	1986	-34.23	ver	-13	-21.23
F _{LOW}	1850.2	GPRS	1850	-31.89	ver	-13	-18.89
F _{LOW}	1850.2	GPRS	3345	-32.01	ver	-13	-19.01
F _{HIGH}	1909.8	GPRS	1913	-28.09	ver	-13	-15.09
F _{LOW}	1850.2	GPRS	14300	-48.92	ver	-13	-35.92
F _{MID}	1880.0	GPRS	2389	-33.05	ver	-13	-20.05
F _{HIGH}	1909.8	GPRS	4880	-50.34	hor	-13	-37.34
F _{LOW}	1852.6	EDGE1900	3921	-30.02	hor	-13	-17.02
F _{LOW}	1852.6	EDGE1900	3896	-29.98	ver	-13	-16.98
F _{MID}	1880.0	EDGE1900	3883	-30.11	ver	-13	-17.11
F _{MID}	1880.0	EDGE1900	14660	-48.2	ver	-13	-35.20
F _{HIGH}	1907.4	EDGE1900	3558	-32.31	hor	-13	-19.31
F _{HIGH}	1907.4	EDGE1900	3921	-29.62	ver	-13	-16.62
Comments: Transmitter does not support HSUPA (customer declaration)							

3.4 Test Conditions and Results – Receiver radiated emissions

Receiver radiated emissions acc. to ISED RSS-210				Verdict: PASS
Test according referenced standards	Reference Method			
	ISED RSS-132 5.6 / 133 6.6			
Test according to measurement reference	Reference Method			
	ANSI C63.4			
Test frequency range	Tested frequencies			
	30 MHz – 5 th Harmonic			
EUT test mode	Receive			
Limits				
Frequency range [MHz]	Detector	Limit [μ V/m]	Limit [dB μ V/m]	Limit Distance [m]
30 – 88	Quasi-Peak	100	40	3
88 – 216	Quasi-Peak	150	43.5	3
216 – 960	Quasi-Peak	200	46	3
960 – 1000	Quasi-Peak	500	54	3
> 1000	Average	500	54	3
Test setup				
 <p>The diagram illustrates the test setup within a semi-anechoic chamber. The chamber has a ground plane at the base. The Equipment Under Test (EUT) is mounted on a turntable. A probe is used to measure the radiated emissions from the EUT. The probe is connected to an amplifier matrix and a measurement receiver located outside the chamber.</p>				

Test procedure							
1. EUT set to receive mode (Communication tester is used if needed) 2. Span it set according to measurement range 3. Resolution bandwidth below 1GHz is set according to CISPR 16 with peak/quasi-peak detector and RBW of 1MHz with peak/average detector is used above 1GHz 4. Markers are set to peak emission levels							
Test results – GSM							
Channel	Frequency [MHz]	Emission [MHz]	Emission Level [db μ V/m]	Emission Level [μ V/m]	Det.	Limit [μ V/m]	Margin [μ V/m]
F _{MID}	836.2	10615	43.34	146.89	pk	500	-353.11
F _{MID}	836.2	3844	44.12	160.69	pk	500	-339.31
F _{MID}	1880	31.63	33.7	48.42	pk	100	-51.58
F _{MID}	1880	6520	48.06	252.93	pk	500	-247.07
Test results – W-CDMA							
Channel	Frequency [MHz]	Emission [MHz]	Emission Level [db μ V/m]	Emission Level [μ V/m]	Det.	Limit [μ V/m]	Margin [μ V/m]
F _{MID}	835.0	30.82	33.8	48.98	pk	100	-51.02
F _{MID}	835.0	3886	44.9	175.79	pk	500	-324.21
F _{MID}	1880	7944	50.41	331.51	pk	500	-168.49
F _{MID}	1880	3657	43.19	144.38	pk	500	-355.62
Comments: * Physical distance between EUT and measurement antenna. ** Emission level corresponds to ambient noise floor							