FCC Test Firm Designation Number: FR0014
Industry Canada Test Firm Number: Site# 9545A-1 / 9545A-2

Matériel testé : *Equipment under test*:	***NEMEUS / MM002-LS-US*** *(Trademark / Marketing name or product reference)*

Client / Demandeur: *Customer / Applicant :*
NEMEUS
Mr. Gilles Ronco
13 rue de la vallée
35220 SAINT DIDIER France

Fabricant : *Manufacturer:*
NEMEUS
13 rue de la vallée
35220 SAINT DIDIER France

Numéro d'affaire : *Work number :* 11845

Référence de la proposition : *Proposal number:* 112016-22265

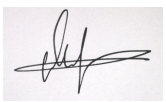
Date de l'essai : *Date of test:* 10 et 11 décembre 2018 / *December 10th and 11th, 2018*

Objectif des essais : *Test purpose*:
EMC qualification accordingly to following standards:
- CFR 47, FCC Part 15, Subpart C
(Chapter 15.247 - Operation within the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz)
- ISED RSS-247, Issue 2
(Digital Transmission Systems Operating in the Bands 902–928 MHz)

Lieu du test: *Test location:*
SMEE, Rue de Taille
38500 VOIRON - France

Test réalisé par : *Test realized by:* Laurent CHAPUS

Conclusion : *Conclusion:*
L'équipement satisfait aux prescriptions des normes citées en référence.
The appliance complies with requirements of above mentioned standards.

Ed.	Date	Modifications / Pages	Written by : Visa	Approved by: Visa
1	February 18, 2019	Initial Edition	Laurent Chapus  Signature numérique de Chapus Laurent	Régis ANCEL  Signature numérique de Ancel Régis

La copie de ce document n'est permise que sous sa forme intégrale. Ce document est le résultat d'essais effectués sur un échantillon. Il ne préjuge pas de la conformité de l'ensemble des produits fabriqués à l'objet essayé.
This document shall not be reproduced, except in full. This document contains results related only to the item tested. It does not imply the conformity of the whole production to the item tested.

cofrac ESSAIS
Accréditation N° 1-6356
Portée disponible sur : *Scope available on :* www.cofrac.fr

Contents

1. Normatives References

FCC qualification according to:		
Standards	**Applied**	**Title**
ANSI C63.4 (2014)	X	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
ANSI C63.10 (2013)	X	American National Standard for Testing Unlicensed Wireless Devices
CFR47, Part 15	X	Telecommunication – Federal Communication Commission – Radio frequency devices, Sections 15.109 / 15.209 / 15.247

ISED qualification according to:		
Standards	**Applied**	**Title**
ICES-003 (Issue 6/2016)	X	Information Technology Equipment (ITE) – Limits and methods of measurement
RSS-Gen (Issue 5/2018)	X	General Requirements and Information for the Certification of Radio Apparatus
RSS-247 (Issue2/2017)	X	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

Note: Following guidance are used
- DTS Measurement Guidance 558074 D01 v05
- Determining ERP and EIRP Guidance 412172 D01 v01r01

Deviation from standard: None

2. Test synthesis

Requirement for Systems using digital modulation techniques (DTS)

TEST	Paragraph number FCC Part 15 / IC RSS-247 / RSS-GEN	Spec. FCC Part 15 / IC RSS-247 / RSS-GEN	RESULTS (comments)
Conducted emissions test	15.207 (a) RSS-Gen § 8.8	Table 15.107 (a) Table 4 / RSS-Gen	**PASS**
6dB Bandwidth	15.247 (a) (2) RSS-247 § 5.2 (a)	At least 500kHz	**PASS**
Maximum Conducted Output Power	15.247 (b) (3) RSS-247 § 5.4 (d)	1W max / 30dBm (Conducted) 4W max / 36dBm (EIRP)	**PASS**
Maximum Power Spectral Density	15.247 (e) RSS-247 § 5.2 (b)	8dBm in a 3kHz band segment	**PASS**
Unwanted emissions into Non Restricted Frequency Bands	15.247 (d) / RSS-247 § 5.5	-30dBc in any 100kHz outside frequency band.	**PASS**
Unwanted emissions into Restricted Frequency Bands	15.209 (a) / 15.247 (d) / 15.205 (a) RSS-GEN § 7.1, §8.9, § 8.10 / RSS-247 § 5.5	Measure at 300m 9-490kHz: 2400µV/m/F(kHz) Measure at 30m 0.490-1.705: 24000µV/m/F(kHz) 1.705-30MHz: 30µV/m Measure at 3m 30MHz-88MHz : 40 dBµV/m 88MHz-216MHz : 43.5 dBµV/m 216MHz-960MHz : 46.0 dBµV/m Above 960MHz : 54.0 dBµV/m	**PASS**
Occupied Bandwidwth	RSS-GEN § 6.7	BW at 99%	**PASS**

Requirement for Hybrid systems (DSS)

TEST	Paragraph number FCC Part 15 / IC RSS-247 / RSS-GEN	Spec. FCC Part 15 / IC RSS-247 / RSS-GEN	RESULTS (comments)
Conducted emissions test	15.207 (a) RSS-Gen § 8.8	Table 15.107 (a) Table 4 / RSS-Gen	**PASS**
20dB Bandwidth	15.247 (a) (1) RSS-247 § 5.1	No requirements	**PASS**
Hopping channel separation	15.247 (a) (1) / RSS-247 5.1 a) b)	Minimum separation 25kHz or the two-third 20dB bandwidth whichever is greater	**PASS**
Number of hopping frequencies	15.247 (a) (1) / RSS-247 5.1 c)	No requirements for hybrid systems	**PASS**
Time of occupancy	15.247 (f) / RSS-247 5.3 a)	Maximum 400ms per channel within 25.6s (64 channels used)	**PASS**
Maximum Conducted Output Power	15.247 (b) (3) RSS-247 § 5.4 (d)	1W max / 30dBm (Conducted) 4W max / 36dBm (EIRP)	**PASS**
Maximum Power Spectral Density	15.247 (e) RSS-247 § 5.2 (b)	8dBm in a 3kHz band segment	**PASS**
Unwanted emissions into Non Restricted Frequency Bands	15.247 (d) / RSS-247 § 5.5	-30dBc in any 100kHz outside frequency band.	**PASS**
Unwanted emissions into Restricted Frequency Bands	15.209 (a) / 15.247 (d) / 15.205 (a) RSS-GEN § 7.1, §8.9, § 8.10 / RSS-247 § 5.5	Measure at 300m 9-490kHz: 2400µV/m/F(kHz) Measure at 30m 0.490-1.705: 24000µV/m/F(kHz) 1.705-30MHz: 30µV/m Measure at 3m 30MHz-88MHz : 40 dBµV/m 88MHz-216MHz : 43.5 dBµV/m 216MHz-960MHz : 46.0 dBµV/m Above 960MHz : 54.0 dBµV/m	**PASS**
Occupied Bandwidwth	RSS-GEN § 6.7	BW at 99%	**PASS**

- **General conclusion:**

Measures and tests performed on the sample of the product *NEMEUS / MM002-LS-US* , in configuration and description presented in this test report, show compliance with standards FCC CFR 47, PART 15, Subpart C and ISED RSS-Gen & RSS-247.

3. Equipment Under Test (EUT)

Nom /
Identification

NEMEUS / MM002-LS-US
(Trademark / Marketing name or product reference)

Sn: Proto1

FCC ID:
IC:
Model:

FCC ID: 2AKSYMM002XUS
IC: 22302-MM002XUS
HVIN: MM002-LS-US

Alimentation /
Power supply

3V DC (RF module via test board)

Auxiliaires /
Auxiliaries

- Laptop ASUS, Model : F200M (with its power supply adapter)
- DC power supply (3V)

Entrées-Sorties /
Input / Output

	Câbles pour essai / *Cables for test*	Blindé / *Shielded*	Prévu pour >3m / *Intended for >3m*
USB cable (Test board)	USB2.0 / 1m	Yes	Yes
DC input (Test board)	2 wires / 1m	No	No

Version programme /
Firmware version

Mode de fonctionnement /
Running mode

The tested sample is able to:
- Transmit a carrier frequency on low, middle and high channels with all modulation schems (LORA 500kHz (DTS) & LORA 125kHz (DSS) / SF 7 to 12).
- Frequency hopping for hybrid system can be enabled or disabled

Programme de test /
Test program /

None

Fréquence max interne EST /
Max internal EUT frequency

50MHz (Except RF frequency)

Information sur l'équipement /
Equipment information

- Frequency band: 902 to 928MHz (Tx & Rx)
- Operating channel: 902.3 to 914.9MHz (125kHz channel width, Hybrid mode)
  903.0 to 914.2MHz (500kHz channel width, DTS mode)
- Spreading factor: Hybrid mode: SF7 to SF10 (Worst case is taken as SF10)
  DTS mode: SF7 to SF12 (Worst case is taken as SF12)
- Number of channels Hybrid mode: 64 channels
  DTS mode: 8 channels
- Channel speacing Hybrid mode: 200kHz
  DTS mode: 1.6MHz
- Power Setting: Power is set at is maximum rated output power (20dBm)
- Modulation: LORA
- Antenna type: External (Dipole antenna, max antenna gain is 2.2dBi)
- Module powered by 3V DC from test board

4. Test conditions

Power supply voltage:
Equipment under test: 3V DC
Auxiliaries: 230V/50Hz (Radiated emission)
110V/60Hz (Conducted emission)

5. Modifications of the EUT

None

6. Special accessory

None

7. Measurement Uncertainty

Test Description	Expanded uncertainty
Conducted emissions test (150k-30MHz, AC mains)	± 3.5dB
Radiated emission test (9kHz-30MHz, electric field)	± 4.0dB
Radiated emission test (30-300MHz, OATS)	± 5.6dB
Radiated emission test (300-1000MHz, OATS)	± 5.3dB
Radiated emission test (1-40GHz, OATS / FAC)	± 5.6dB
Conducted RF output power at antenna port	± 1.6dB
Radiated RF output power (Peak, Power density)	± 5.6dB
DTS Bandwidth, 99% OBW	±4%
Temperature	± 1°C
Time and duty cycle calculation	±1%
AC and DC voltage	±1%

Note: Expended uncertainty at 95% confidence (k=2)

8. Field Strength Calculation

The field strength (level) is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation is as follow:
FS = RA + AF + CF – AG
Where FS = Field Strength (Level)
RA = Receiver Amplitude (Meter Reading)
AF = Antenna Factor
CF = Cable Factor
AG = Amplifier Gain
Margin value = Emission level – Limit value

Example:
RA: 14.0dBµV / AF: 16.5 dBm^{-1} / CF: 3.5dB / AG: 15dB
→ Total factor: 5dBm^{-1}
→ Field level: 19.0dBµV/m (-21.0dB for margin if limit is 40dBµV/m)

9. Conducted Emission Measurement (150kHz-30MHz)

TEST: Limits for conducted disturbance 150kHz – 30MHz	**Verdict**
Method: The LISN is placed 0,8 m from the boundary of the unit under test and bonded to a ground reference plane. This distance was between the closest points of the AMN and the EUT. All other units of the EUT and associated equipment were at least 0,8 m from the AMN. All power was connected to the system through Artificial Mains Network (AMN). Conducted voltage measurements on lines were made at the output of the LISN. The EUT is 80cm above the ground reference plane and 40cm from the vertical ground plane. The AC power cable is 1m length.	**Pass**

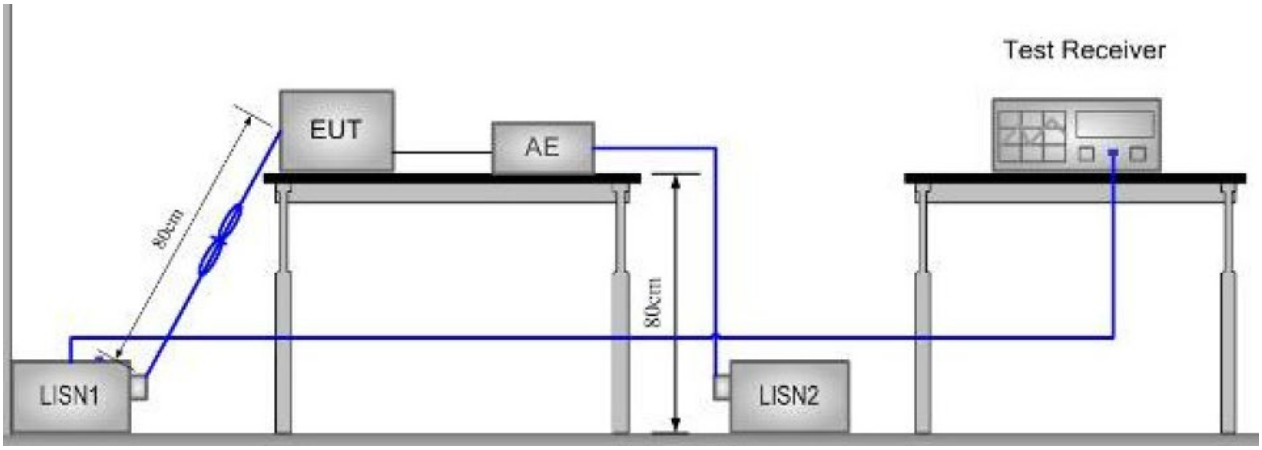
Laboratory Parameters:	Required prior to the test	During the test
Ambient Temperature	20 to 30 °C	22°C ± 2
Relative Humidity	25 to 70 %	40% ± 5
Fully configured sample scanned over the following frequency range	Frequency range on each side of line	Measurement Point
	150kHz to 30MHz	AC input port (110V)

Limits

Frequency (MHz)	Limit dB (µV)			
	Quasi-Peak	Result	Average	Result
0.15 – 0.50	66 \ 56	**PASS**	56 \ 46	**PASS**
0.50 - 5	56	**PASS**	46	**PASS**
5 – 30	60	**PASS**	50	**PASS**

Supplementary information:
Test location: SMEE
Test date: December 10th, 2018. Tested by L. CHAPUS
Power supply voltage: AC mains 110V/60Hz

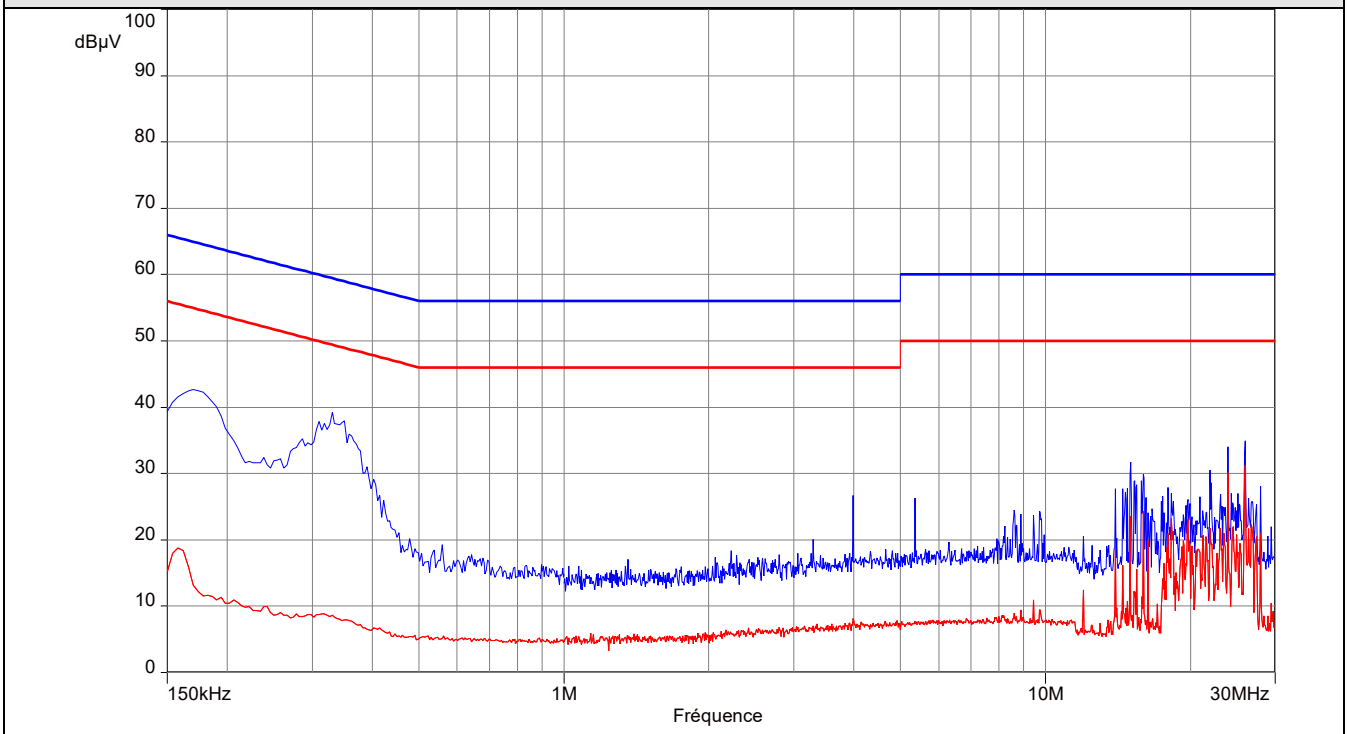
Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Attenuator / limiter	SMEE	ATT#2	ATT-171-010	2018/6	2019/6
Cable RF	Div	1m	CAB-101-021	2018/4	2019/4
LISN (50Ω / 50µH) (Meas.)	AFJ	LS16C	RSI-101-001	2017/6	2019/6
Measuring receiver	Rohde&Schwarz	ESRP	REC-151-002	2017/5	2019/5
EMC Software	NEXIO	BAT EMC V3.8	SOF-101-001	-	-
AC power supply	PACIFIC POWER	AMX-125	ALI-101-002	-	-

Test Setup for conducted emission
 *Ground reference plane*

Tabulated Results for Mains Terminal Disturbance Voltage on AC port								
FREQ	**Meas. PK**	**Mes. QP**	**LIMIT QP**	**Margin QP**	**Mes. AV**	**LIMIT AV**	**Margin AV**	Line
(MHz)	(dBµV)	(dBµV)	(dBµV)	(dB)	(dBµV)	(dBµV)	(dB)	
Levels are at least 20dB below limits								L1 / N

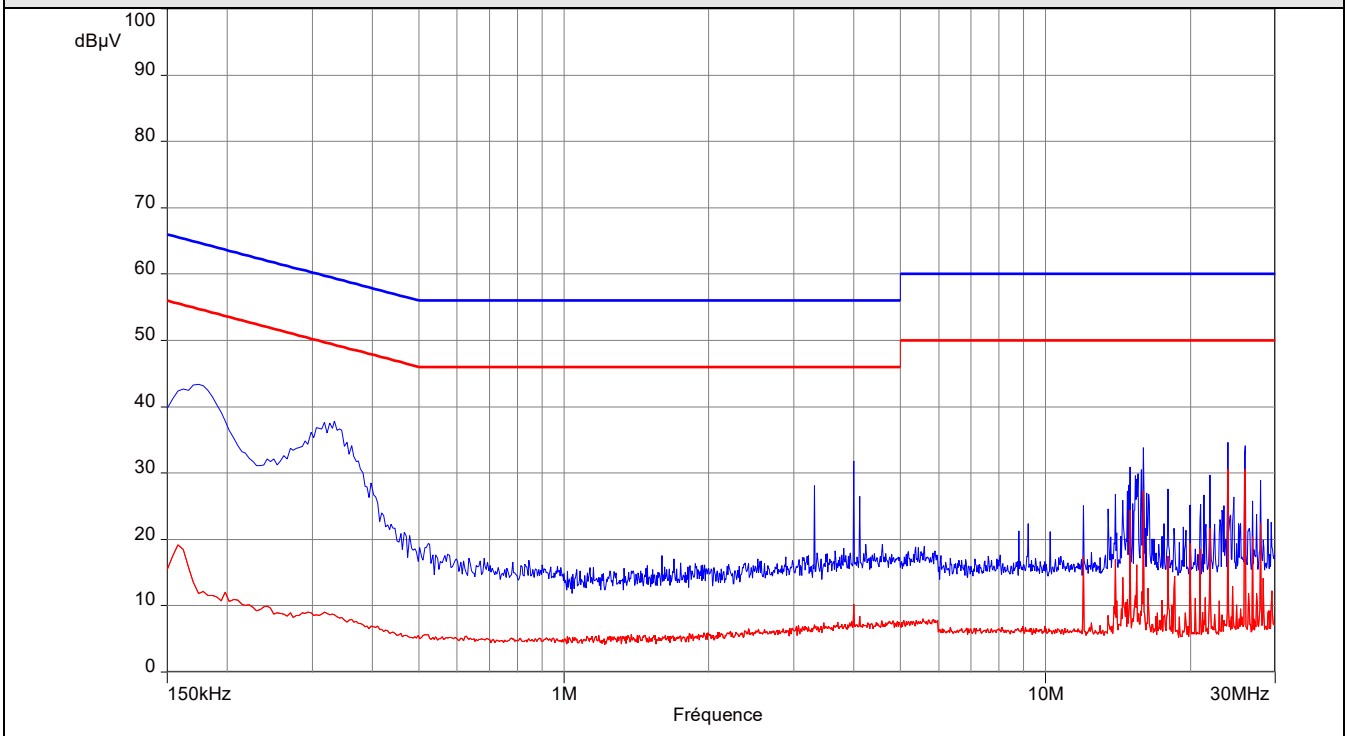
Frequency band investigated:	150kHz-30MHz
RBW:	9kHz
Voltage:	110V/60Hz
Limit:	FCC Part 15.209 a) / RSS-Gen: Issue 5, §8.8 Table 4
Final measurement detector:	Quasi-Peak and CISPR Average (AV)
RESULT:	PASS
Measured value calculation:	The measured value (level) is calculated by adding the Cable Factor, the Transient suppressor attenuation and LISN attenuation from the receiver amplitude reading. The basic equation is as follow: Meas. = RA + CF + ATT_{TRAN} + ATT_{LISN} Where Meas. = Level (dBµV) RA = Receiver Amplitude CF = Cable Factor ATT_{TRAN} = Transient suppressor attenuation ATT_{LISN} = LISN attenuation Margin value = Emission level – Limit value (A negative margin shows compliance to limit)

Graphical representation of Conducted Disturbance Measurement (Peak and Average detection)
AC port, Line L1



----: Peak | ----: Average

Graphical representation of Conducted Disturbance Measurement (Peak and Average detection)
AC port, Line Neutral



----: Peak | ----: Average

10. DTS Bandwidth (6dB)

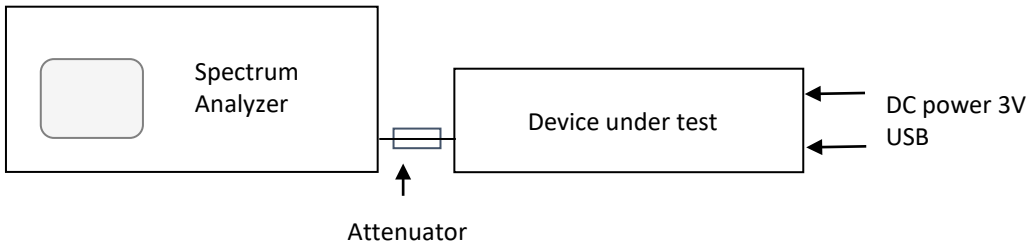
TEST: 6dB Bandwidth		**Verdict**
Method: The setup is in an anechoic chamber. The spectrum analyzer is connected to the antenna port of the device under test. A conducted measurement is performed. The RBW is 100kHz, with VBW ≥ 3 x RBW. Sweep time is set to Auto couple. The SPAN is wide enough to capture all products of the modulation process. A MaxHold Peak detector is used. Automatic function of the spectrum analyser is used. The tested equipment is set to transmit operation with modulation on low, mid and high channels.		**Pass**
Laboratory Parameters:	Required prior to the test	During the test
Ambient Temperature	20 to 30 °C	22°C ± 2
Relative Humidity	25 to 70 %	40% ± 5

Limits – FCC Part 15.247 (a) / RSS-247 §5.2 (a)		
Frequency (MHz)	**Level for Bandwidth**	**Limit**
903.0	6dB below the maximum output power	At least 500kHz
907.8		
914.2		

Supplementary information:
Test location: SMEE.
Test date: December 10th, 2018. Tested by L. CHAPUS

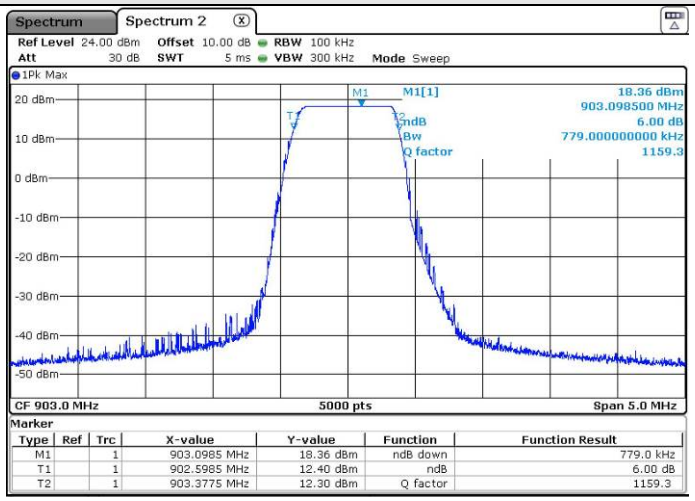
Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Attenuator	Mini-Circuit	BW-N10W5+	ATT-171-008	2018/4	2019/4
Spectrum analyzer	Rohde&Schwarz	FSV40	ASP-171-004	2017/5	2019/5

Test Setup for conducted antenna port measurement

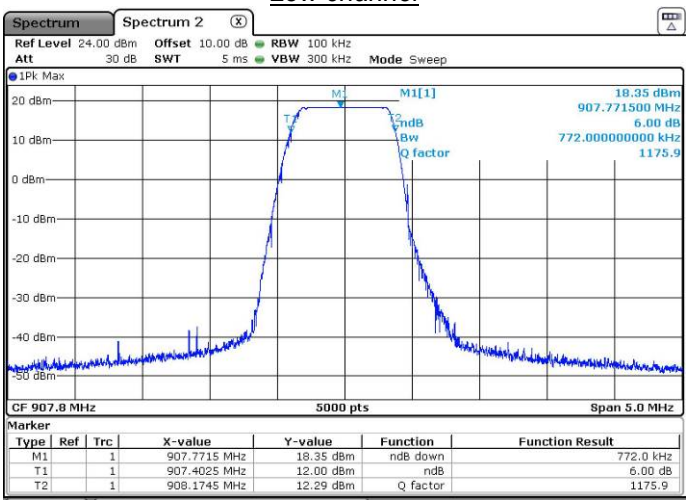


Tabulated Results for Occupied Bandwidth		
Frequency (MHz)	**6dB Bandwidth** (kHz)	**Result**
903.0	779.0	**Pass**
907.8	772.0	**Pass**
914.2	771.0	**Pass**

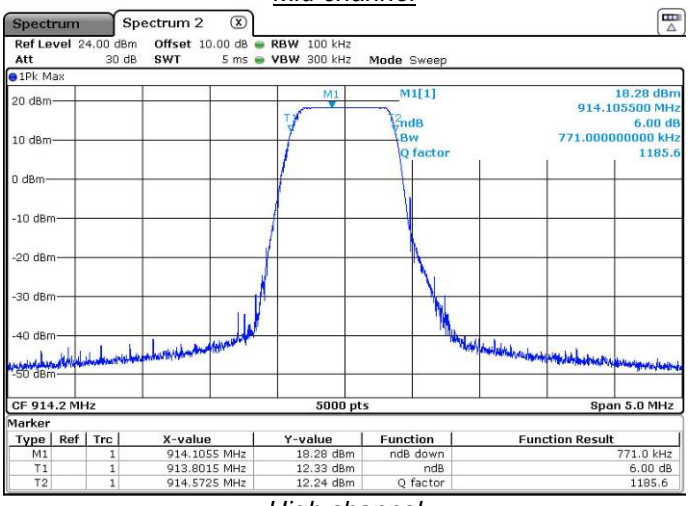
Graphical representation of 6dB Bandwidth



Low channel



Mid channel



High channel

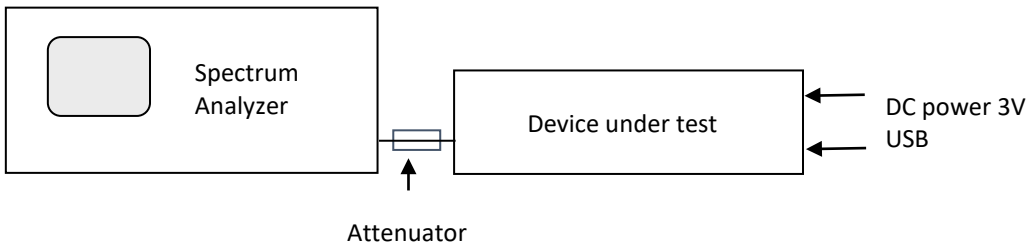
Frequency band investigated:	903 / 907.8 / 914.2MHz (DTS 500kHz mode)
RBW :	100kHz
Measurement detector :	Peak / Max hold

11. Channel Separation

TEST: Hopping channel measurement (Separation)		**Verdict**
Method: The Equipment under test is connected to the measuring receiver with suitable mean. The SPAN is wide enough to capture the peaks of two adjacent channels. The channel separation is measured with the hopping function enable on the EUT. Limits: Minimum separation between channels shall be 25kHz or the two-third 20dB bandwidth, whichever is greater.		**Pass**
Laboratory Parameters:	Required prior to the test	During the test
Ambient Temperature	20 to 30 °C	22°C ± 2
Relative Humidity	25 to 70 %	40% ± 5
Supplementary information: Test location: SMEE. Test date: December 10th, 2018. Tested by L. CHAPUS		

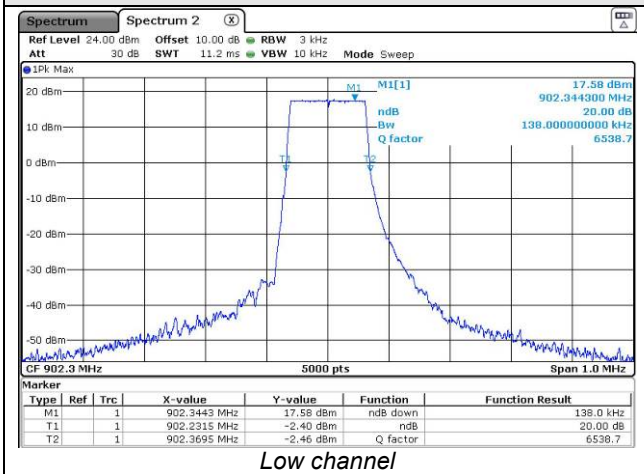
Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Attenuator	Mini-Circuit	BW-N10W5+	ATT-171-008	2018/4	2019/4
Spectrum analyzer	Rohde&Schwarz	FSV40	ASP-171-004	2017/5	2019/5

Test Setup for conducted antenna port measurement

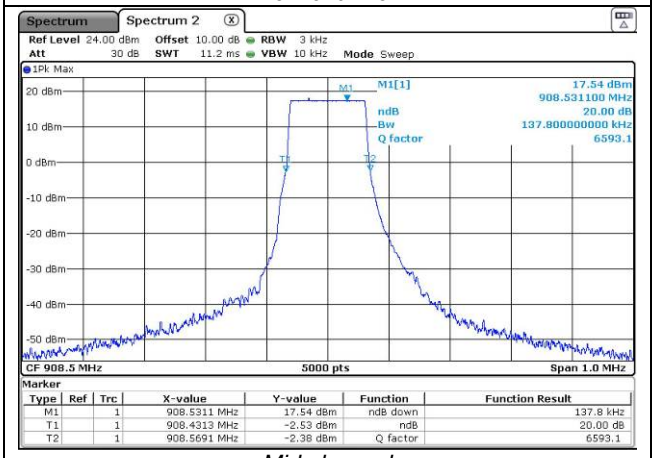


Tabulated Results for Hopping Channel Separation (Hybrid mode)				
Channel frequency	**Adjacent channel separation**	**20dB Bandwidth**	**Minimum limit**	**Result**
(MHz)	(kHz)	(kHz)	(kHz)	
902.3	**200.0**	138.0	92.000	PASS
908.5		137.8	91.867	PASS
914.9		138.2	92.133	PASS

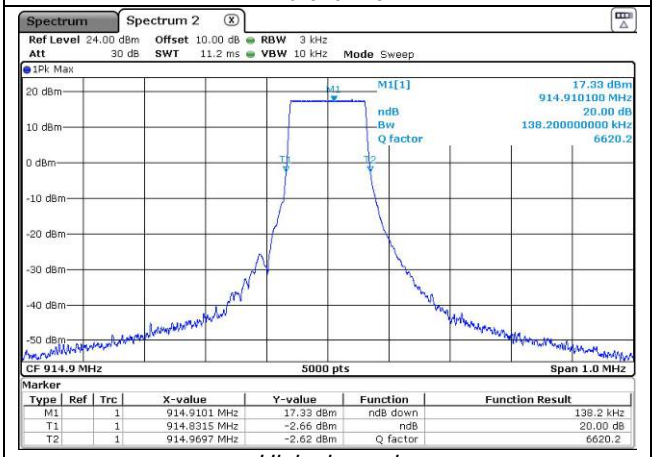
Graphical representation of 20dB Bandwidth & Hopping channel separation



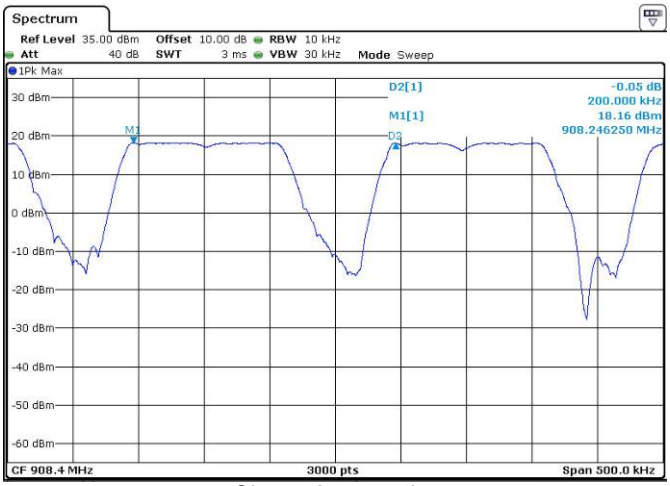
Low channel



Mid channel



High channel



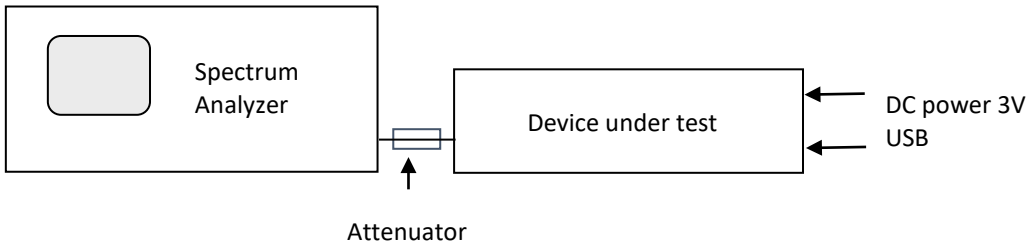
Channel separation

12. Number of hopping channels

TEST: Number of hopping channels		**Verdict**
Method: The Equipment under test is connected to the measuring receiver with suitable mean. The SPAN is adapted to see the frequency band of operation. The spectrum analyzer RBW was 10kHz and VBW was 100kHz. The EUT has its hopping function enable. Limits: At least 15 channels frequencies shall be used and equally spaced, in the band 2400-2483MHz.		**Pass**
Laboratory Parameters:	Required prior to the test	During the test
Ambient Temperature	20 to 30 °C	22°C ± 2
Relative Humidity	25 to 70 %	40% ± 5
Supplementary information: Test location: SMEE. Test date: December 10th, 2018. Tested by L. CHAPUS		

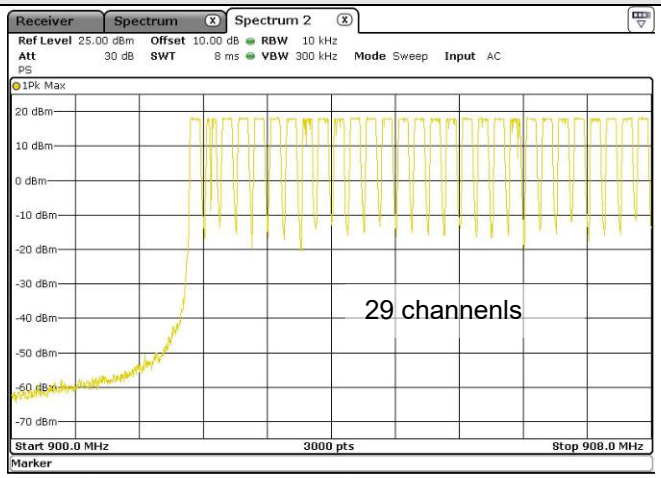
Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Attenuator	Mini-Circuit	BW-N10W5+	ATT-171-008	2018/4	2019/4
Spectrum analyzer	Rohde&Schwarz	FSV40	ASP-171-004	2017/5	2019/5

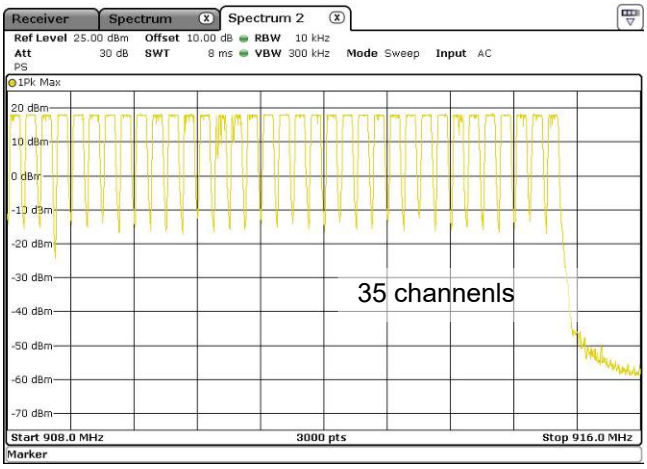
Test Setup for conducted antenna port measurement



Tabulated Results for Number of Hopping Channel		
Number of channels	**Minimum number of channels**	**Result**
64	-	PASS

Graphical representation for Number of Hopping Channel



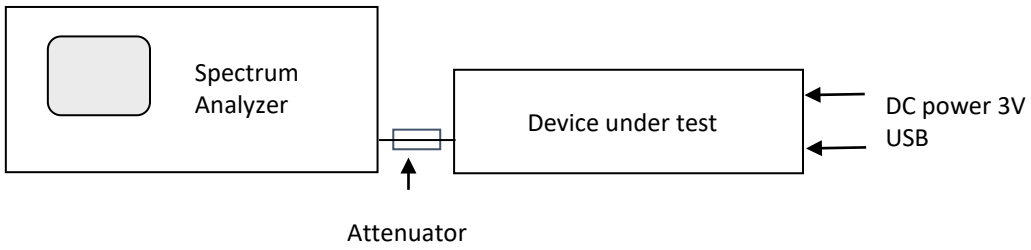


13. Average Time of occupancy

TEST: Time of occupancy		**Verdict**
Method: The Equipment under test is connected to the measuring receiver with suitable mean. The spectrum analyser is set to zero-span. The EUT has its hopping function enable. Limits: 400ms of transmission by channel on a period 25.6s. (64 channels used)		**Pass**
Laboratory Parameters:	Required prior to the test	During the test
Ambient Temperature	20 to 30 °C	22°C ± 2
Relative Humidity	25 to 70 %	40% ± 5
Supplementary information: Test location: SMEE. Test date: December 10th, 2018. Tested by L. CHAPUS		

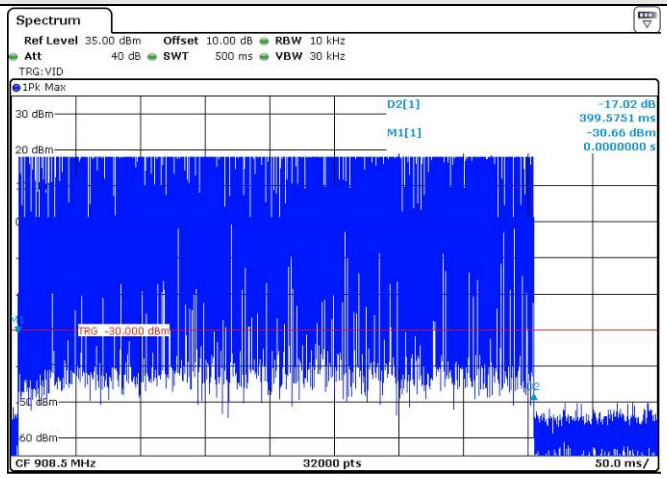
Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Attenuator	Mini-Circuit	BW-N10W5+	ATT-171-008	2018/4	2019/4
Spectrum analyzer	Rohde&Schwarz	FSV40	ASP-171-004	2017/5	2019/5

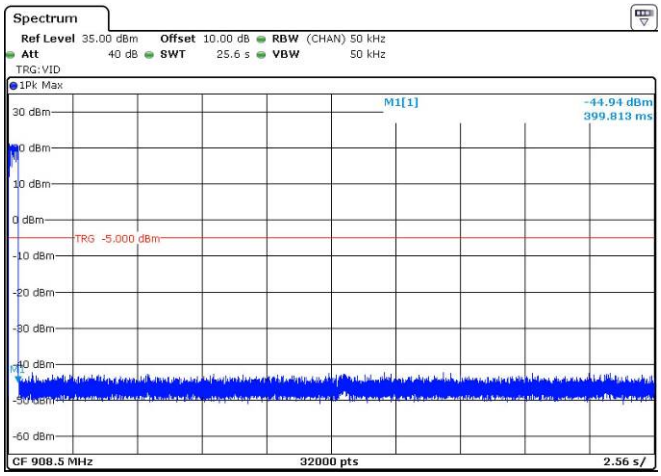
Test Setup for conducted antenna port measurement



Tabulated Results for Dwell time				
Number of pulses per 25.6s period	**Length of 1 pulse (ms)**	**Average Time of occupancy (ms)**	**Limit (ms)**	**Result**
1	399.5751	399.5751	400ms	PASS
Additional information: Results for the worst case Period of 25.6s (0.4s x 64 channels)				

Graphical representation for dwell time



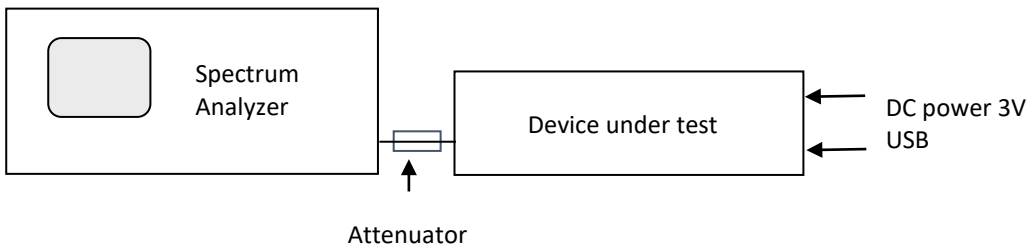


14. Fundamental emission output power

TEST: Maximum conducted (Average) output power		**Verdict**
Method: The setup is in an anechoic chamber. The spectrum analyzer is connected to the antenna port of the device under test. A conducted measurement is performed. The tested equipment is set to transmit operation with modulation on low, mid and high channels.		**Pass**
Laboratory Parameters:	Required prior to the test	During the test
Ambient Temperature	20 to 30 °C	22°C ± 2
Relative Humidity	25 to 70 %	40% ± 5
Limits – FCC Part 15.247 (b) / RSS-247 §5.4		
Frequency (MHz)	Limits (dBµV/m)	
	Level / Detector / Distance	Results
902.3 to 914.9	36 dBm / Pk / 3m (Radiated, EIRP)	**Pass**
902.3 to 914.9	30 dBm / Pk (Conducted)	**Pass**
Supplementary information: Test location: SMEE. Test date: December 10th, 2018. Tested by L. CHAPUS		

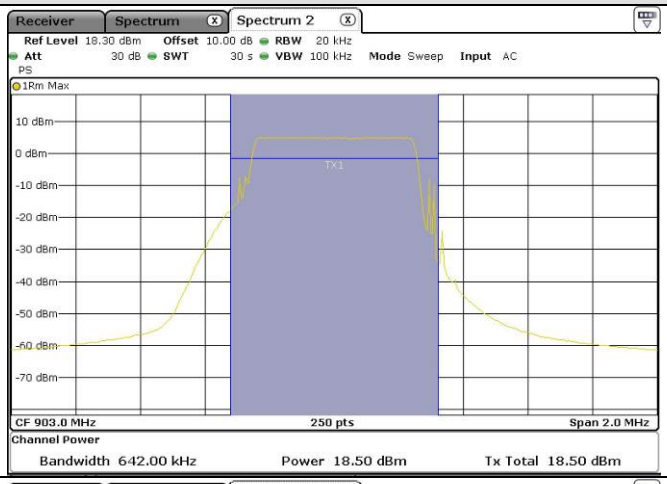
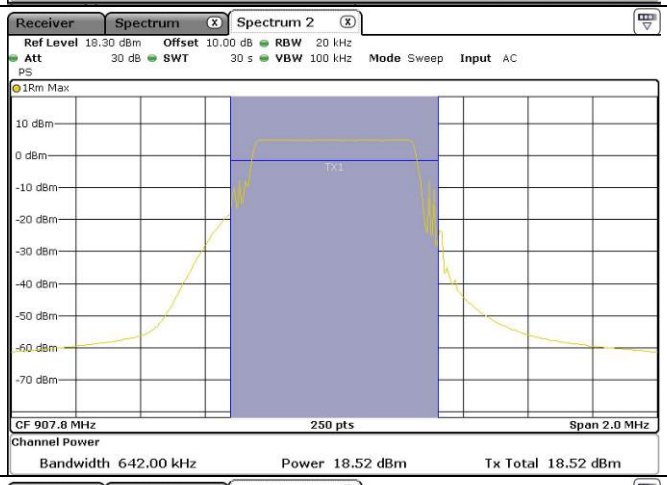
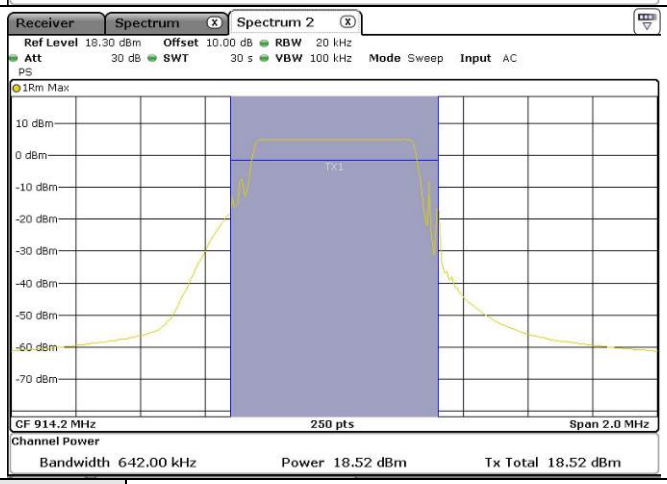
Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Attenuator	Mini-Circuit	BW-N10W5+	ATT-171-008	2018/4	2019/4
Spectrum analyzer	Rohde&Schwarz	ESRP	REC-151-002	2017/5	2019/5

Test Setup for conducted antenna port measurement

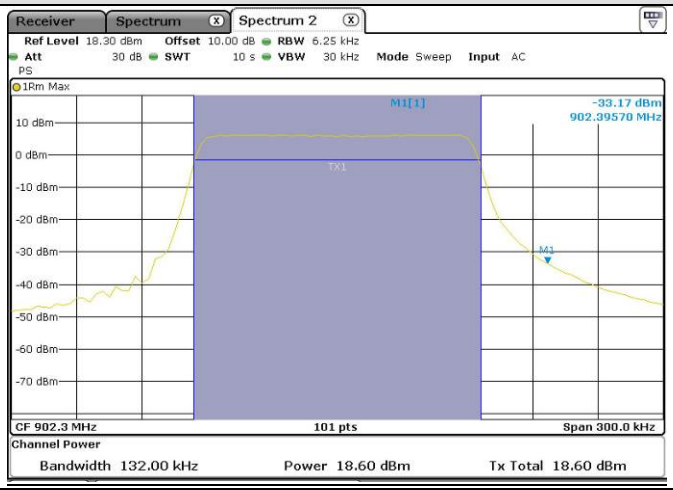
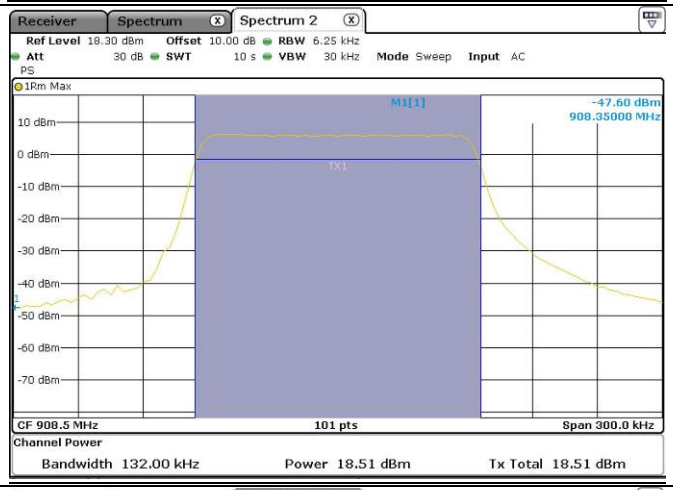
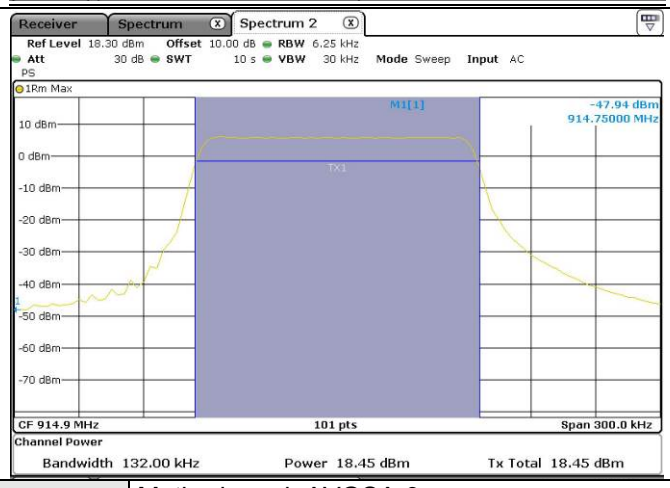


Tabulated Results for Maximum (Average) output power (Conducted)					
FREQ (MHz)	**Measured conducted power** (dBm)	**Duty cycle factor** (dB)	**Maximum output power** (dBm)	**Limit** (dBm)	**Result**
903.0 / DTS	**18.5**	NA	**18.5**	**30.0**	**Pass**
907.8 / DTS	**18.5**	NA	**18.5**	**30.0**	**Pass**
914.2 / DTS	**18.5**	NA	**18.5**	**30.0**	**Pass**
902.3 / Hybrid	**18.6**	NA	**18.6**	**30.0**	**Pass**
908.5 / Hybrid	**18.5**	NA	**18.5**	**30.0**	**Pass**
914.9 / Hybrid	**18.5**	NA	**18.5**	**30.0**	**Pass**
RESULT:		PASS			
Note:		- Method used is AVGSA-3 - Duty cycle factor is 10*log (1/x) where x is the duty cycle			

Tabulated Results for Maximum (Average) output power (Radiated)					
FREQ (MHz)	**Maximum output power Conducted** (dBm)	**Antenna Gain** (dBi)	**Maximum output power Radiated** (dBm)	**Limit** (dBm)	**Result**
903.0 / DTS	**18.5**	2.2	**20.7**	**36.0**	**Pass**
907.8 / DTS	**18.5**	2.2	**20.7**	**36.0**	**Pass**
914.2 / DTS	**18.5**	2.2	**20.7**	**36.0**	**Pass**
902.3 / Hybrid	**18.6**	2.2	**20.8**	**36.0**	**Pass**
908.5 / Hybrid	**18.5**	2.2	**20.7**	**36.0**	**Pass**
914.9 / Hybrid	**18.5**	2.2	**20.7**	**36.0**	**Pass**
RESULT:		PASS			

Graphical representation of output power (DTS / 500kHz mode)




Note:	Method used: AVGSA-3 Channel power function of the spectrum analyser used.

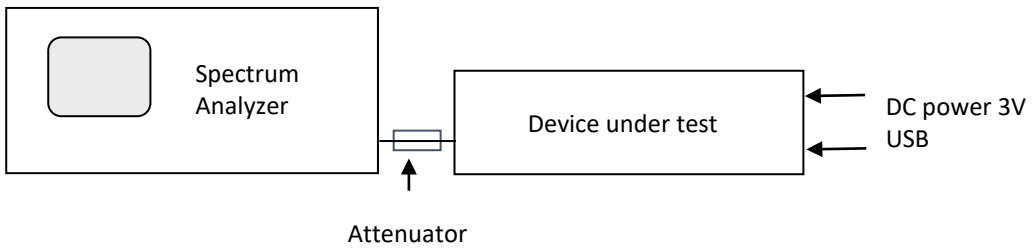
Graphical representation of output power (Hybrid / 125kHz mode)	
	
	
	
Note:	Method used: AVGSA-3 Channel power function of the spectrum analyser used.

15. Maximum Power Spectral Density Level in the fundamental emission

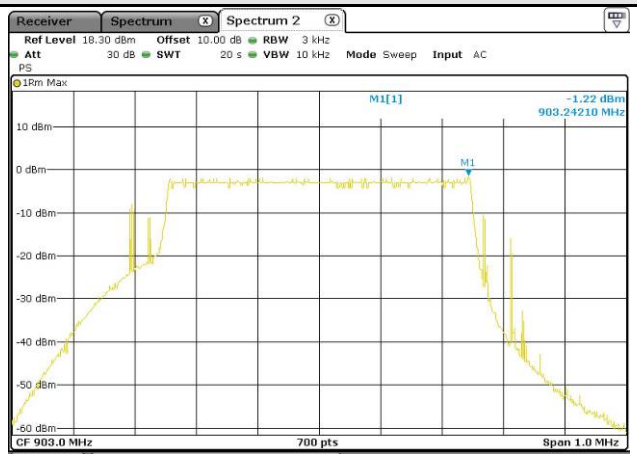
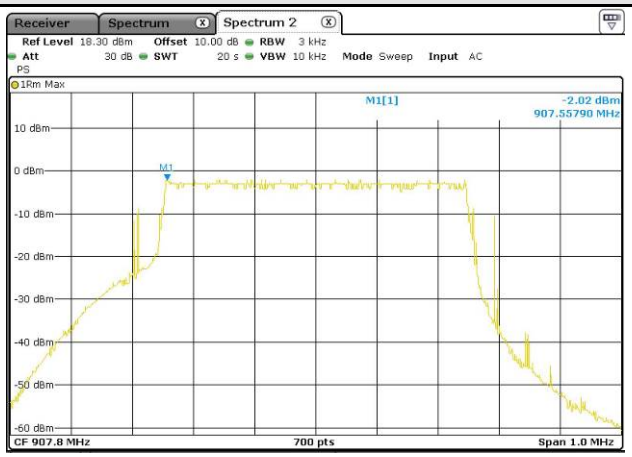
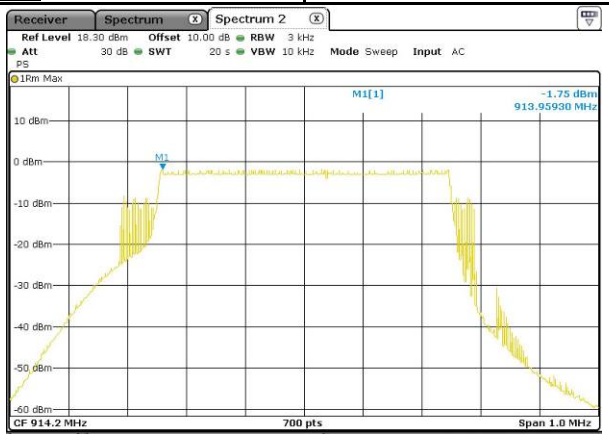
TEST: Maximum Peak Power Spectral Density		**Verdict**
Method: The setup is in an anechoic chamber. The spectrum analyzer is connected to the antenna port of the device under test. A conducted measurement is performed. The tested equipment is set to transmit operation with modulation on low, mid and high channels.		**Pass**
Laboratory Parameters:	Required prior to the test	During the test
Ambient Temperature	20 to 30 °C	22°C ± 2
Relative Humidity	25 to 70 %	40% ± 5
Limits – FCC Part 15.247 (e) / RSS-247 §5.2 (b)		
Frequency (MHz)	**Level**	**Limit**
902.3 to 914.9	8 dBm/3kHz	**Pass**
Supplementary information: Test location: SMEE. Test date: December 10th, 2018. Tested by L. CHAPUS		

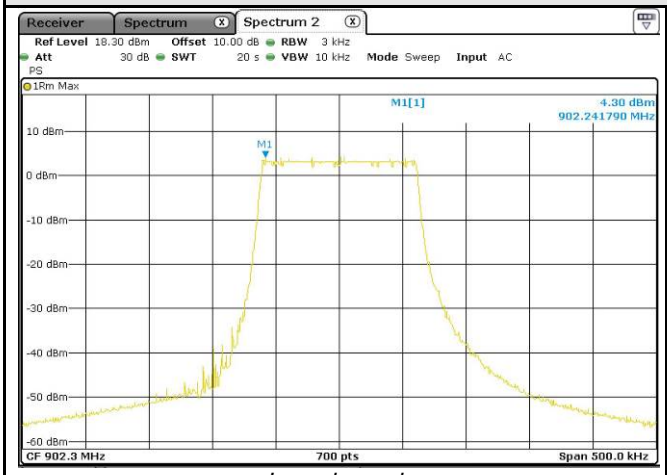
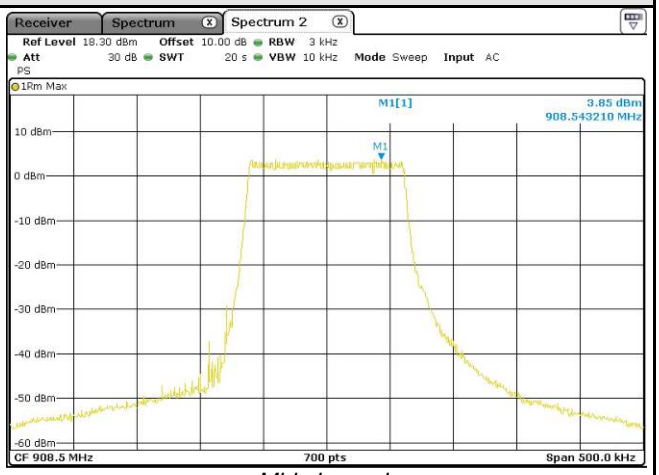
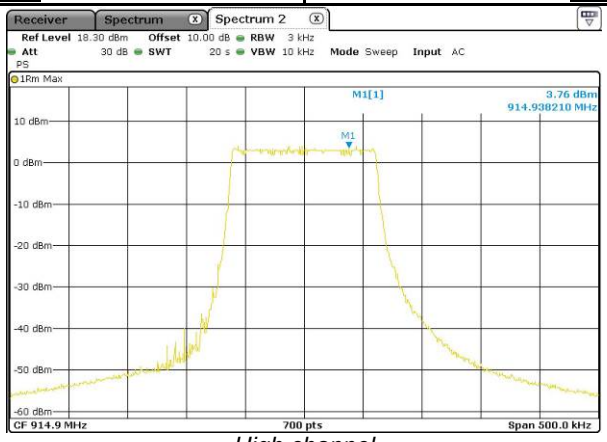
Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Attenuator	Mini-Circuit	BW-N10W5+	ATT-171-008	2018/4	2019/4
Spectrum analyzer	Rohde&Schwarz	ESRP	REC-151-002	2017/5	2019/5

Test Setup for conducted antenna port measurement



Tabulated Results for Maximum Conducted Power Spectral Density			
Frequency (MHz)	**PSD (dBm/3kHz)**	**Limit**	**Result**
903.0 / DTS	-1.2	8dBm/3kHz	**Pass**
907.8 / DTS	-2.0	8dBm/3kHz	**Pass**
914.2 / DTS	-1.7	8dBm/3kHz	**Pass**
902.3 / Hybrid	4.3	8dBm/3kHz	**Pass**
908.5 / Hybrid	3.9	8dBm/3kHz	**Pass**
914.9 / Hybrid	3.8	8dBm/3kHz	**Pass**
RBW:	3kHz		
Limit:	FCC Part 15.247 / RSS-247		
RESULT:	PASS		
Note:	- Method used is AVGPSD-3		

Graphical representation for Maximum Power Spectral Density (DTS / 500kHz mode)	
 *Low channel*	 *Mid channel*
 *High channel*	
RBW:	3kHz
Limit:	FCC Part 15.247 / RSS-247
RESULT:	PASS

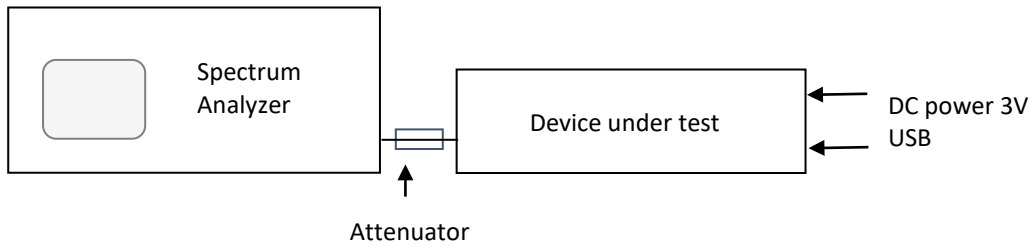
Graphical representation for Maximum Power Spectral Density (Hybrid / 125kHz mode)	
 *Low channel*	 *Mid channel*
 *High channel*	
RBW:	3kHz
Limit:	FCC Part 15.247 / RSS-247
RESULT:	PASS

16. Unwanted Spurious Emissions (Conducted emissions)

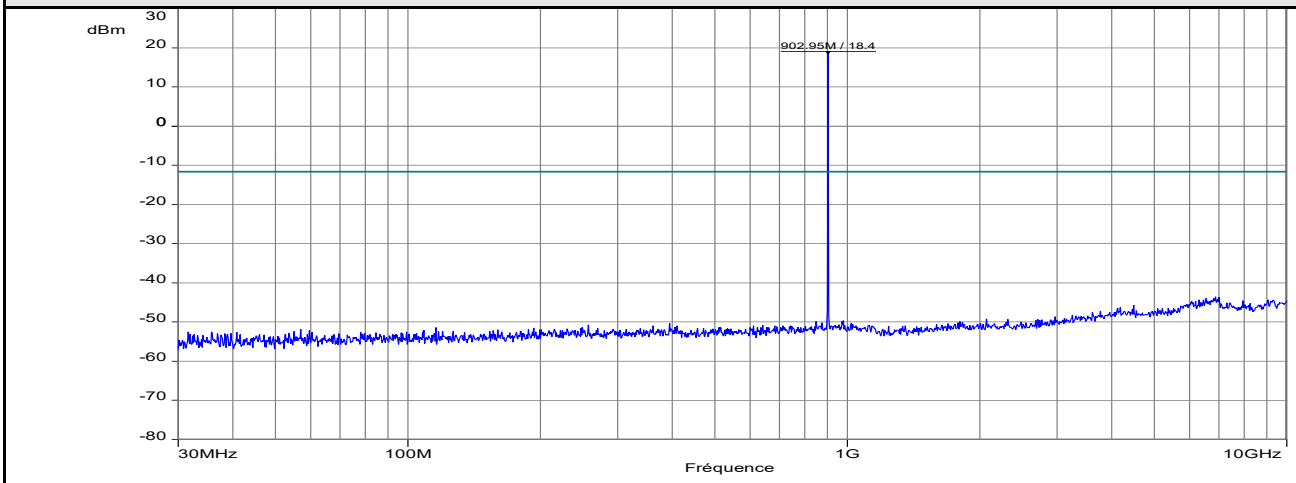
TEST: Conducted Spurious emissions			**Verdict**
Method: The setup is in an anechoic chamber. The spectrum analyzer is connected to the antenna port of the device under test. A conducted measurement is performed. The tested equipment is set to transmit operation with modulation on low, mid and high channels.			**Pass**
Laboratory Parameters:	Required prior to the test		During the test
Ambient Temperature	20 to 30 °C		22°C ± 2
Relative Humidity	25 to 70 %		40% ± 5
Fully configured sample scanned over the following frequency range	Frequency range on each side of line		Measurement Point
	30MHz – 10GHz		Antenna port
Limits – FCC Part 15.247 (d) / RSS-247 § 5.5			
Frequency (MHz)	Limits (dBµV/m)		
	Detector / Analyser RBW	Limit	Results
30 to 10000	Pk / 100kHz	30dB below the maximum Peak level	**Pass**
Supplementary information: Test location: SMEE. Test date: December 10th, 2018. Tested by L. CHAPUS			

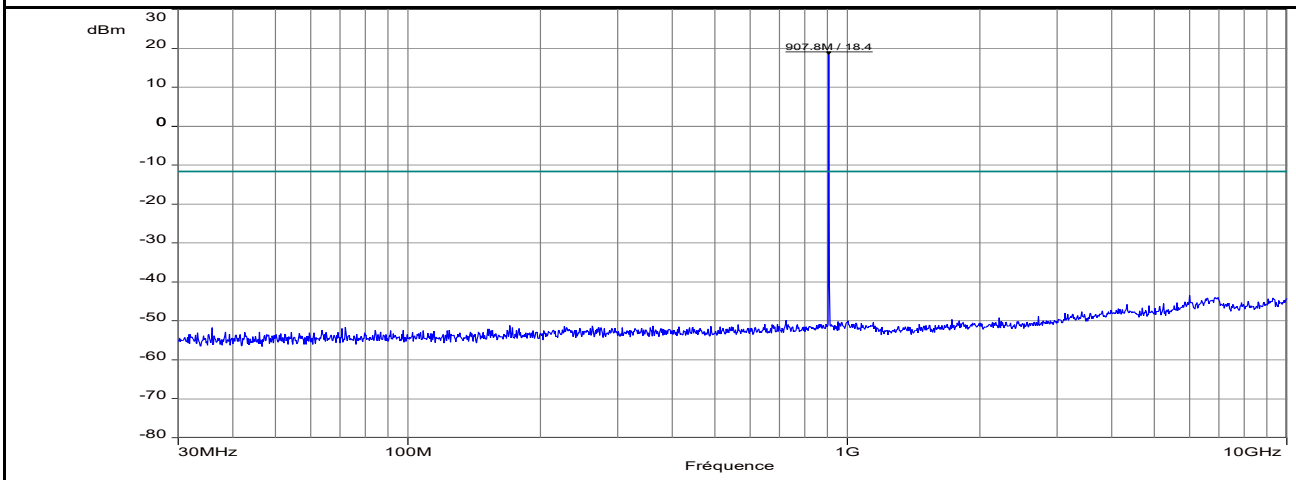
Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Attenuator	Mini-Circuit	BW-N10W5+	ATT-171-008	2018/4	2019/4
Spectrum analyzer	Rohde&Schwarz	FSV40	ASP-171-004	2017/5	2019/5

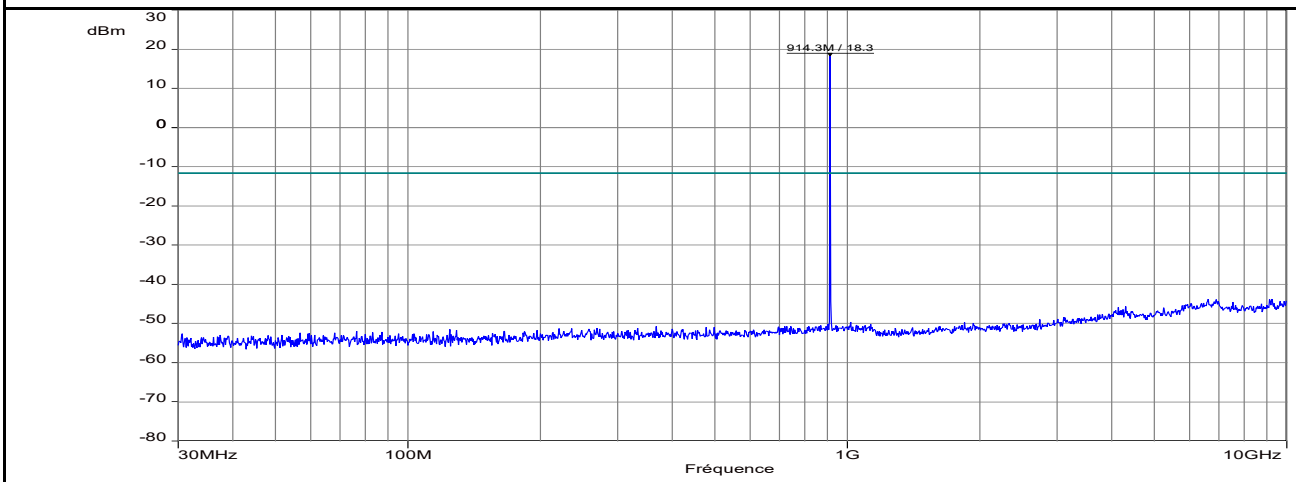
Test Setup for conducted antenna port measurement



Graphical representation of Conducted Spurious emissions (DTS / 500kHz mode / Low, Mid, High channels)

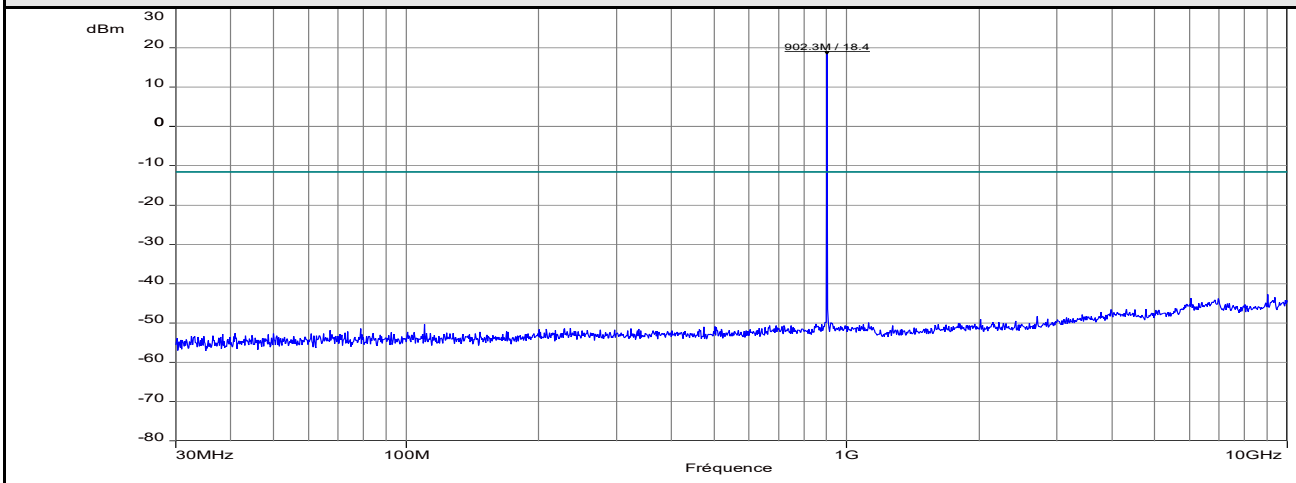


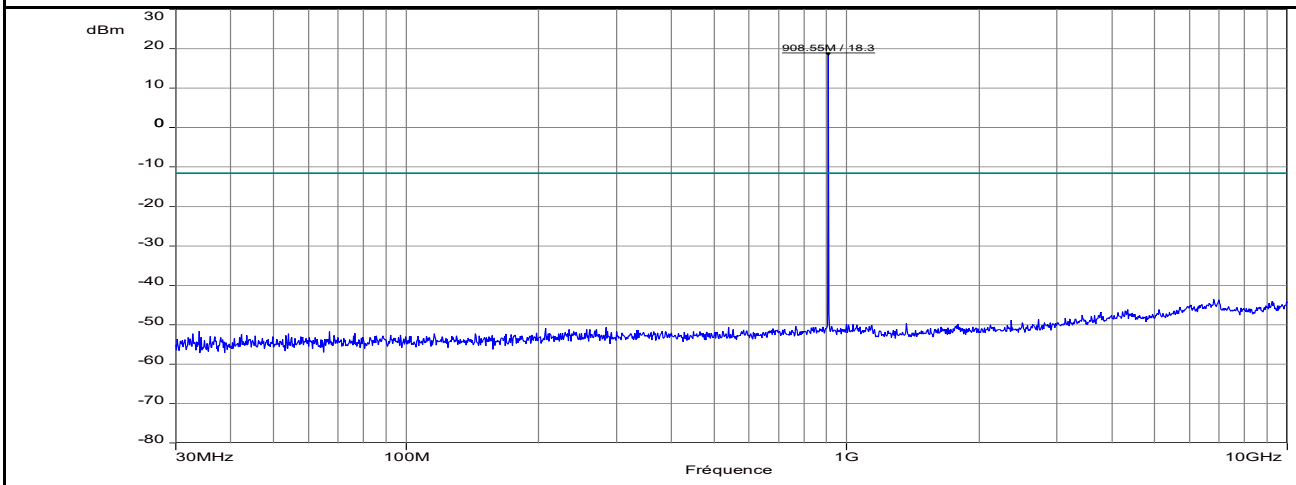


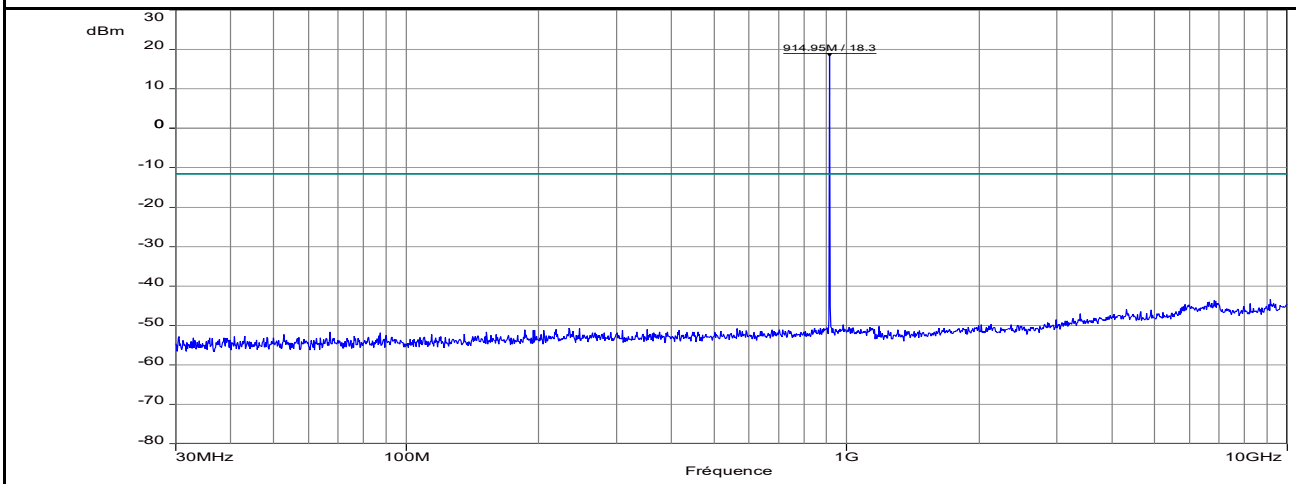


Frequency band investigated:	30MHz-10GHz
Unit :	dBm
RBW :	100kHz (Frequency step 50kHz)
Measurement detector:	Peak
Limit:	-11.6dBm

Graphical representation of Conducted Spurious emissions (Hybrid / 125kHz mode / Low, Mid, High channels)



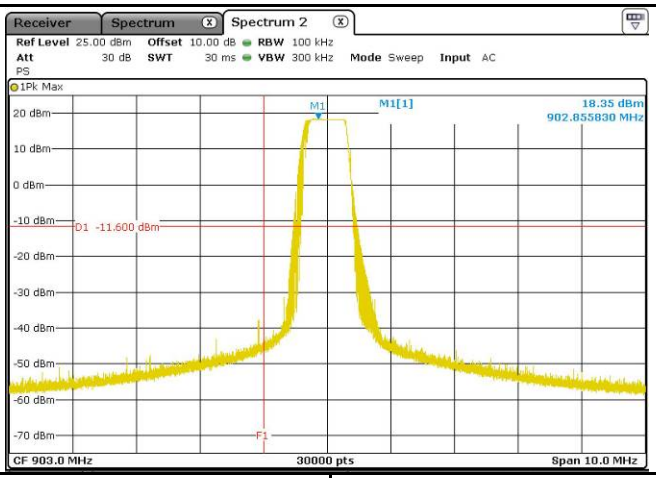




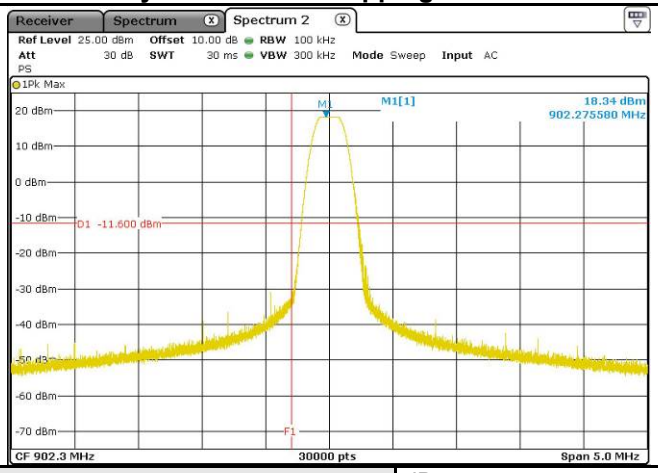
Frequency band investigated:	30MHz-10GHz
Unit :	dBm
RBW :	100kHz (Frequency step 50kHz)
Measurement detector:	Peak
Limit:	-11.6dBm

Graphical representation of Band-edge compliance (LOW)

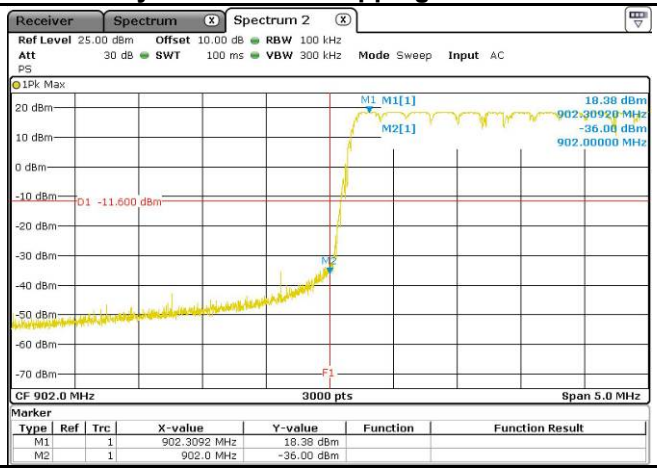
DTS / 500kHz mode



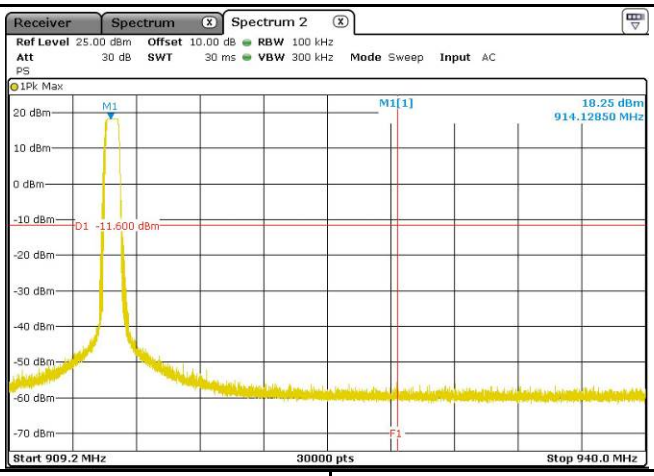
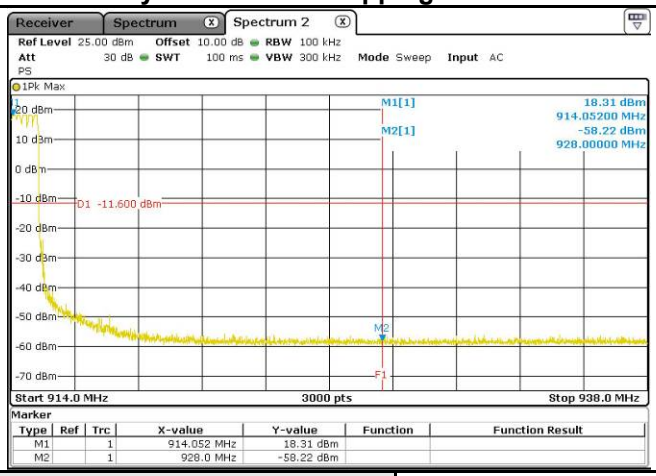
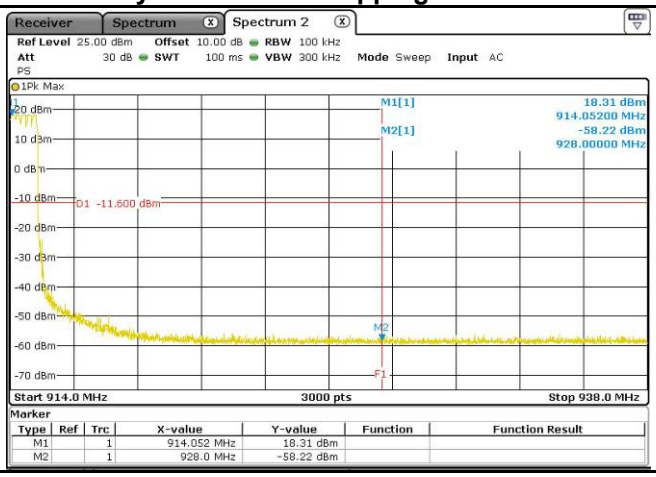
Hybrid 125kHz / Hopping Disable



Hybrid 125kHz / Hopping Enabled



Unit :	dBm
RBW :	100kHz
Measurement detector:	Peak
Limit:	-11.6dBm
Note:	F1 is 902MHz

Graphical representation of Band-edge compliance (HIGH)	
DTS / 500kHz mode	
	
Hybrid 125kHz / Hopping Disable	**Hybrid 125kHz / Hopping Enabled**
	

Unit :	dBm
RBW :	100kHz
Measurement detector:	Peak
Limit:	-11.6dBm
Note:	F1 is 928MHz

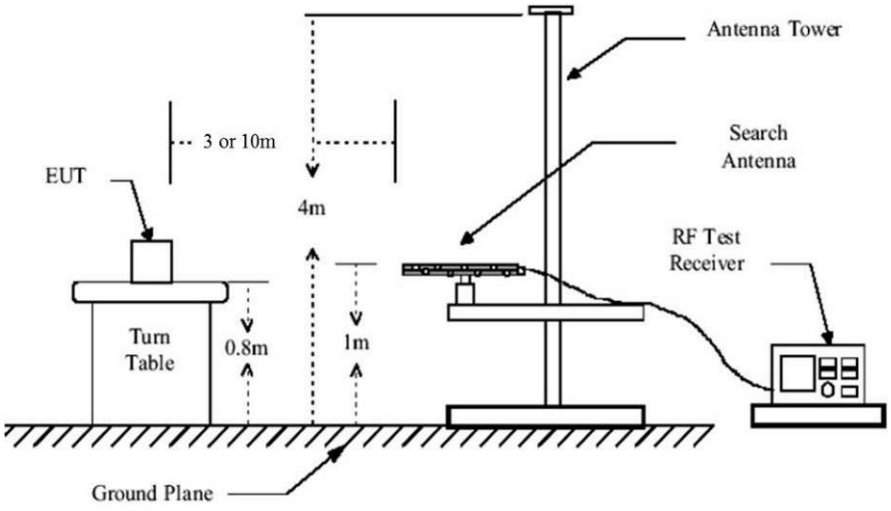
17. Unwanted emissions in Non-Restricted Frequency bands (Radiated emissions)

TEST: Unwanted emissions in Non-Restricted Frequency Bands			**Verdict**
Method: Measurements were performed on a 3-meter Open Area Test Site (OATS) for frequency below 1GHz. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in horizontal and vertical polarities. Final measurements (Peak) were then performed by rotating the EUT on 360° and adjusting the receive antenna height from 1 to 4 m For frequency above 1GHz, final measurements were made at 3m in a Full Anechoic Chamber (FAC) that complies with ANSI C63.10. Measurements were performed at an antenna to EUT separation distance of 3 meter. The EUT was rotated 360° about its azimuth with the receive antenna in horizontal and vertical polarities. Three orthogonal axis measurements on EUT are performed to obtain the maximum peak field strength, with 60° rotation on each axis. (Clause 6.6.5 of ANSI C63.10). A pre-scan frequency identification of the EUT has been performed in full anechoic chamber. The measured radiated field of the EUT is performed (or corrected) at 3-meters of distance. Antenna is 1.25-meters high. The pre-characterization graphs are obtained in PEAK detection with 360° continuous rotation of the device under test.			**Pass**
Laboratory Parameters:	Required prior to the test		During the test
Ambient Temperature	20 to 30 °C		22°C ± 2
Relative Humidity	25 to 70 %		40% ± 5
Fully configured sample scanned over the following frequency range	Frequency range on each side of line		Measurement Point
	30MHz – 10GHz		3 m measurement distance
Limits – FCC Part 15.247 (d) / RSS-247 § 5.5			
Frequency (MHz)	Limits (dBµV/m)		
	Detector / Analyser RBW	Limit	Results
30 to 10000	Pk / 100kHz	30dB below the maximum Peak level	**Pass**
Supplementary information: Test location: SMEE. Test date: December 11th, 2018. Tested by L. CHAPUS			

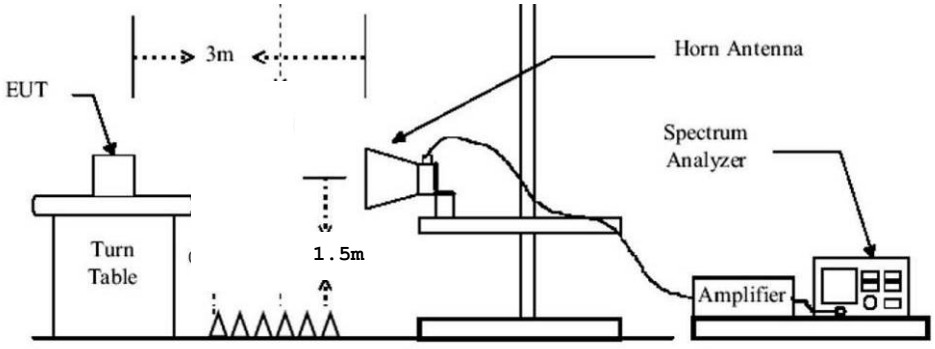
Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Log-periodic antenna	TDK	PLP3003	ANT-101-001	2017/5	2019/5
Biconnic antenna	COM-POWER	AB- 900	ANT-101-003	2017/5	2019/5
BiConiLog antenna	EMCO	3142B	ANT-101-010	2017/7	2019/7
Horn antenna	ETS-LINDGREN	3115	ANT-141-013	2018/10	2021/10
Spectrum analyzer	Rohde&Schwarz	FSV40	ASP-171-004	2017/5	2019/5
RF cable	Div	OATS/25m	CAB-101-017	2018/4	2019/4
RF cable	Pasternack RF	PE302-120	CAB-131-024	2018/4	2019/4
RF cable	HUBER+SUHNER	RG214U	CAB-141-026	2018/4	2019/4
RF cable	HUBER+SUHNER	RG214U	CAB-141-029	2018/4	2019/4
RF cable	HUBER+SUHNER	SF104	CAB-141-030	2018/4	2019/4
Anechoic chamber	COMTEST	214263	CAG-141-001	2017/6	2020/6

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Antenna mast	Innco- Systems	MA4000EP	MAT-101-001	-	-
Turntable	Innco- Systems	DS1200S	PLA-101-001	-	-
Turntable	Innco- Systems	CT0800	PLA-141-001		
Pre-amplifier	Pasternack RF	1524	PRE-101-002	2018/4	2019/4
Measuring receiver	Rohde&Schwarz	ESRP	REC-151-003	2017/5	2019/5
OATS	Div	10m	SIT-101-001	2017/7	2020/7
EMC Software	NEXIO	BAT EMC V3.8	SOF-101-001	-	-

Test Setup for radiated emission



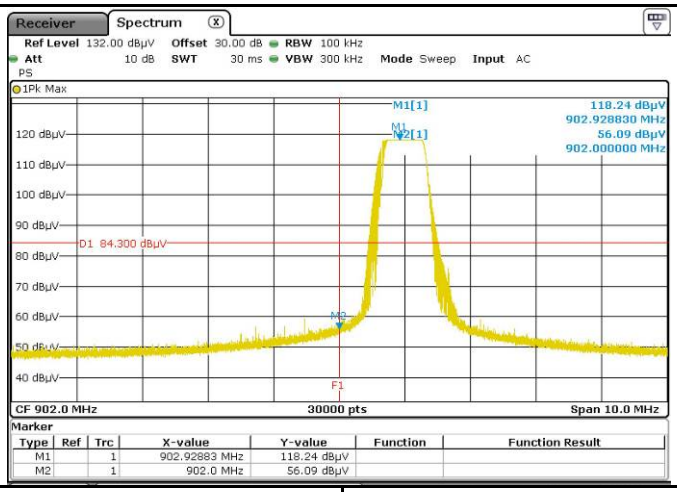
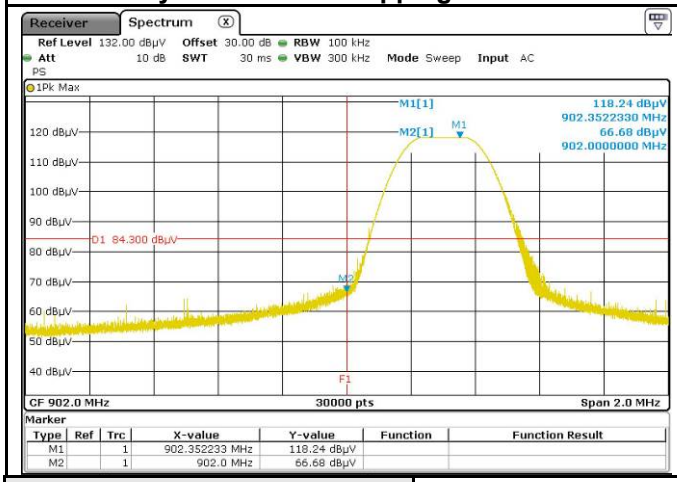
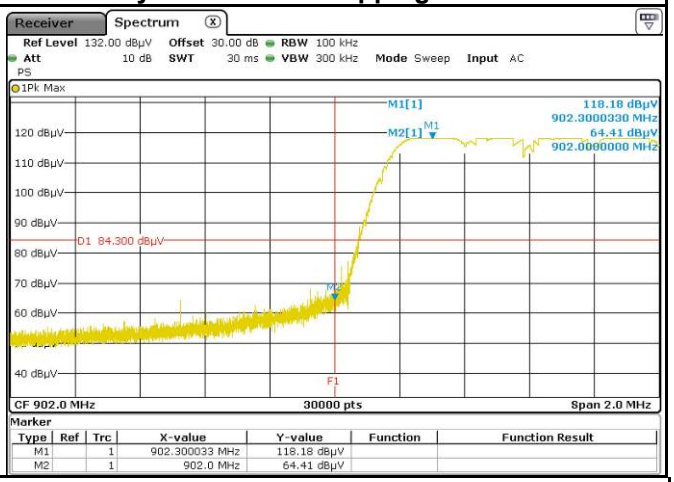
Test setup for 30-1000MHz



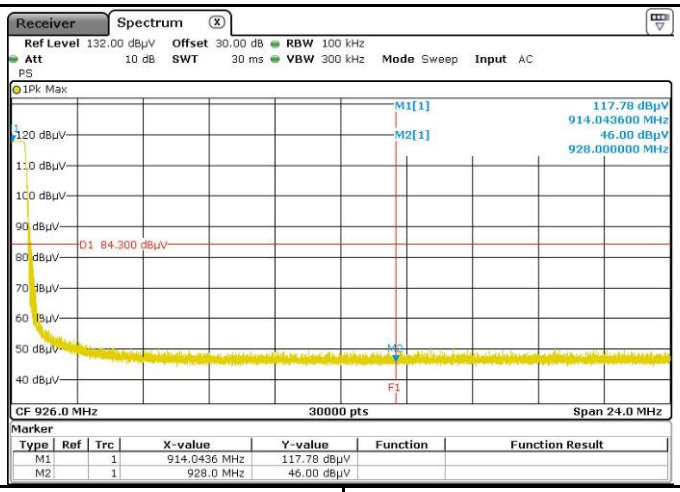
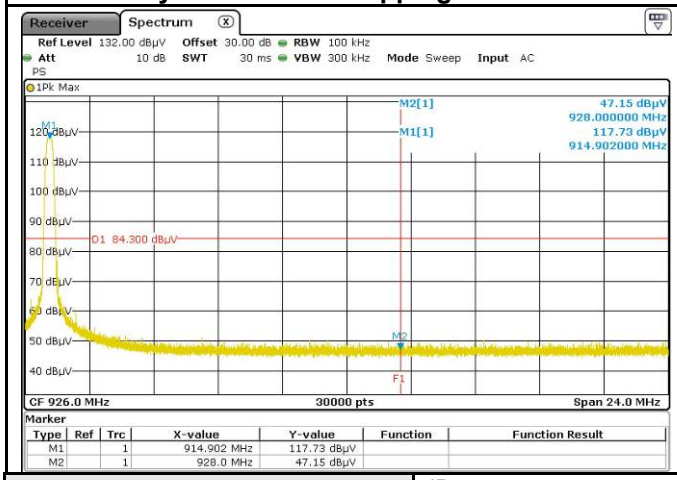
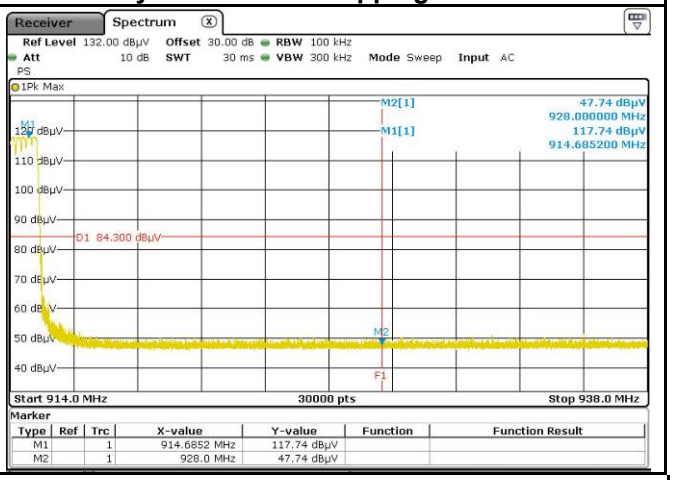
Test setup for 1-25GHz

Tabulated Results for Peak Output Radiated level	
FREQ (MHz)	**Field Strength 3m** (dBµV/m)
903.0 / DTS	118.2
907.8 / DTS	118.2
914.2 / DTS	117.8
902.3 / Hybrid	118.2
908.5 / Hybrid	118.2
914.9 / Hybrid	117.8
RBW:	100kHz
Measurement distance:	3m
Limit:	Ref. level only – For 15.247 (d) / RSS-247 § 5.5
Final measurement detector:	Peak
Note:	(1): Only for identification of limit in non-restricted band Limit is **87.8 dBµV/m** Peak for out-of-band frequencies in Non-Restricted bands (with a 100kHz RBW on the spectrum analyser)

Tabulated Results for Unwanted emissions in Non-Restricted bands				
FREQ (MHz)	**Field Strength 3m** (dBµV/m)	**Limit** (dBµV/m)	**Margin** (dBµV/m)	**Result** (dBµV/m)
Levels are at least 10dB below the 87.8dBµV/m limit				
RBW:	100kHz			
Measurement distance:	3m			
Limit:	15.247 / RSS-247			
Final measurement detector:	Peak			
RESULT:	PASS			
Note:	(1): The field strength (level) is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation is as follow: FS = RA + AF + CF – AG Where FS = Field Strength RA = Receiver Amplitude AF = Antenna Factor CF = Cable Factor AG = Amplifier Gain Total factor (dB) is AF + CF – AG Margin value = Emission level – Limit value (2): Peak pre-scans not performed at 3-meters distance are corrected as follow: $M@3m = M@D_m + 20 \times \log (D_m / 3_m)$ Where D is the measurement distance in meter (3): All frequencies not specified have margin < -10dB (4): Worst case between charge mode and normal used mode (5): 3-axis measurement performed for device under test.			

Graphical representation of Band-edge compliance (LOW)	
DTS / 500kHz mode	
	
Hybrid 125kHz / Hopping Disable	**Hybrid 125kHz / Hopping Enabled**
	

Unit :	dBµV/m
RBW :	100kHz
Measurement detector:	Peak
Limit:	87.8 dBµV/m
Note:	F1 is 902MHz

Graphical representation of Band-edge compliance (HIGH)	
DTS / 500kHz mode	
	
Hybrid 125kHz / Hopping Disable	**Hybrid 125kHz / Hopping Enabled**
	

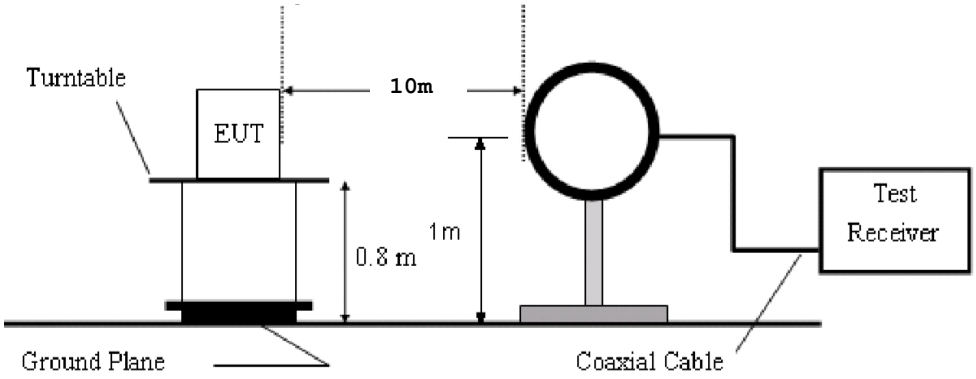
Unit :	dBm
RBW :	100kHz
Measurement detector:	Peak
Limit:	87.8 dBµV/m
Note:	F1 is 928MHz

18. Unwanted emissions in Restricted Frequency bands

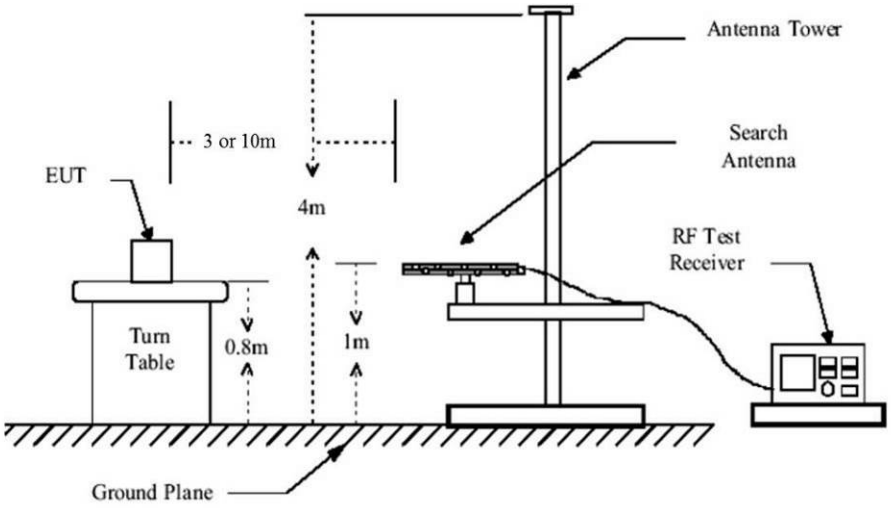
TEST: Unwanted emissions into Restricted Frequency Bands			**Verdict**
Method: Measurements were performed on a 10 or 3-meter Open Area Test Site (OATS) for frequency below 1GHz. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in horizontal and vertical polarities. Final measurements (Peak) were then performed by rotating the EUT on 360° and adjusting the receive antenna height from 1 to 4 m for frequency between 30MHz to 1GHz. For frequency above 1GHz, final measurements were made at 3m in a Full Anechoic Chamber (FAC) that complies with ANSI C63.10. Measurements were performed at an antenna to EUT separation distance of 3 meter. The EUT was rotated 360° about its azimuth with the receive antenna in horizontal and vertical polarities. Three orthogonal axis measurements on EUT are performed to obtain the maximum peak field strength, with 60° rotation on each axis.(Clause 6.6.5 of ANSI C63.10). A pre-scan frequency identification of the EUT has been performed in full anechoic chamber. The measured radiated field of the EUT is performed (or corrected) at 3-meters of distance. Antenna is 1.25-meters high. The pre-characterization graphs are obtained in PEAK detection with 360° continuous rotation of the device under test.			**Pass**
Laboratory Parameters:	Required prior to the test	During the test	
Ambient Temperature	20 to 30 °C	22°C ± 2	
Relative Humidity	25 to 70 %	40% ± 5	
Fully configured sample scanned over the following frequency range	Frequency range on each side of line	Measurement Point	
	9kHz – 30MHz	10 m measurement distance	
	30MHz – 10GHz	3 m measurement distance	
Limits – FCC Part 15.205, 15.209 (a), 15.247 (d) / RSS-GEN §8.9, §8.10, RSS-247 §5.5			
Frequency (MHz)	Limits (dBµV/m)		
	Level / Detector / Distance	Results	
0.009 to 0.090	107.6 – 87.6 / AV / 10m 127.6 – 107.6 / PK / 10m	**Pass**	
0.090 to 0.110	87.6 – 85.9 / QP / 10m	**Pass**	
0.110 to 0.490	85.7 – 72.9 / AV / 10m 105.7 – 92.9 / PK / 10m	**Pass**	
0.490 to 1.705	52.9 – 42.1 / QP / 10m	**Pass**	
1.705 to 30	48.6 / QP / 10m	**Pass**	
30 to 88	40.0 / QP / 3m	**Pass**	
88 to 216	43.5 / QP / 3m	**Pass**	
216 to 960	46.0 / QP / 3m	**Pass**	
960-1000	54.0 / QP / 3m	**Pass**	
Above 1GHz	54.0 / AV / 3m 74.0 / PK / 3m	**Pass**	
Supplementary information: Test location: SMEE. Test date: December 11th, 2018. Tested by L. CHAPUS			

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Log-periodic antenna	TDK	PLP3003	ANT-101-001	2017/5	2019/5
Biconnic antenna	COM-POWER	AB- 900	ANT-101-003	2017/5	2019/5
Loop antenna	EMCO	6502	ANT-101-009	2017/8	2019/8
BiConiLog antenna	EMCO	3142B	ANT-101-010	2017/7	2019/7
Horn antenna	ETS-LINDGREN	3115	ANT-141-013	2018/10	2021/10
Horn antenna	ETS-LINDGREN	3116	ANT-161-014	2017/12	2022/12
Spectrum analyzer	Rohde&Schwarz	FSV40	ASP-171-004	2017/5	2019/5
RF cable	Div	OATS/25m	CAB-101-017	2018/4	2019/4
RF cable	Pasternack RF	PE302-120	CAB-131-024	2018/4	2019/4
RF cable	HUBER+SUHNER	RG214U	CAB-141-026	2018/4	2019/4
RF cable	HUBER+SUHNER	RG214U	CAB-141-029	2018/4	2019/4
RF cable	HUBER+SUHNER	SF104	CAB-141-030	2018/4	2019/4
RF cable	HUBER+SUHNER	SF102 (K/2m)	CAB-171-034	2017/5	2019/5
RF cable	HUBER+SUHNER	SF102 (K/3m)	CAB-171-034	2017/5	2019/5
Anechoic chamber	COMTEST	214263	CAG-141-001	2017/6	2020/6
Antenna mast	Innco- Systems	MA4000EP	MAT-101-001	-	-
Turntable	Innco- Systems	DS1200S	PLA-101-001	-	-
Turntable	Innco- Systems	CT0800	PLA-141-001		
Pre-amplifier	Pasternack RF	1524	PRE-101-002	2018/4	2019/4
Pre-amplifier	SMEE	18-40GHz	PRE-171-004	2017/12	2018/12
Measuring receiver	Rohde&Schwarz	ESRP	REC-151-003	2017/5	2019/5
OATS	Div	10m	SIT-101-001	2017/7	2020/7
EMC Software	NEXIO	BAT EMC V3.8	SOF-101-001	-	-

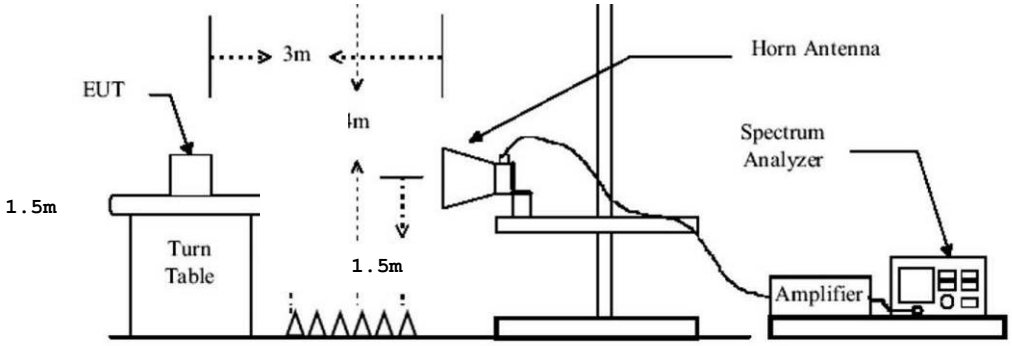
Test Setup for radiated emission



Test setup for 9k-30MHz



Test setup for 30-1000MHz



Test setup for 1-10GHz

Tabulated Results for Unwanted emissions (9kHz-30MHz)						
FREQ	**RF field @ 30m**	**Limit @ 30m**	**Margin**	**Antenna angle**	**Table angle**	**Correc. Fact. (CF)**
MHz	(QP) dBµV/m	(QP) dBµV/m	dB	Degree	Degree	dB
Margin < -10dB						
Supplementary information: Frequency list measured on the Open Area Test Site has been created with pre-scan results.						

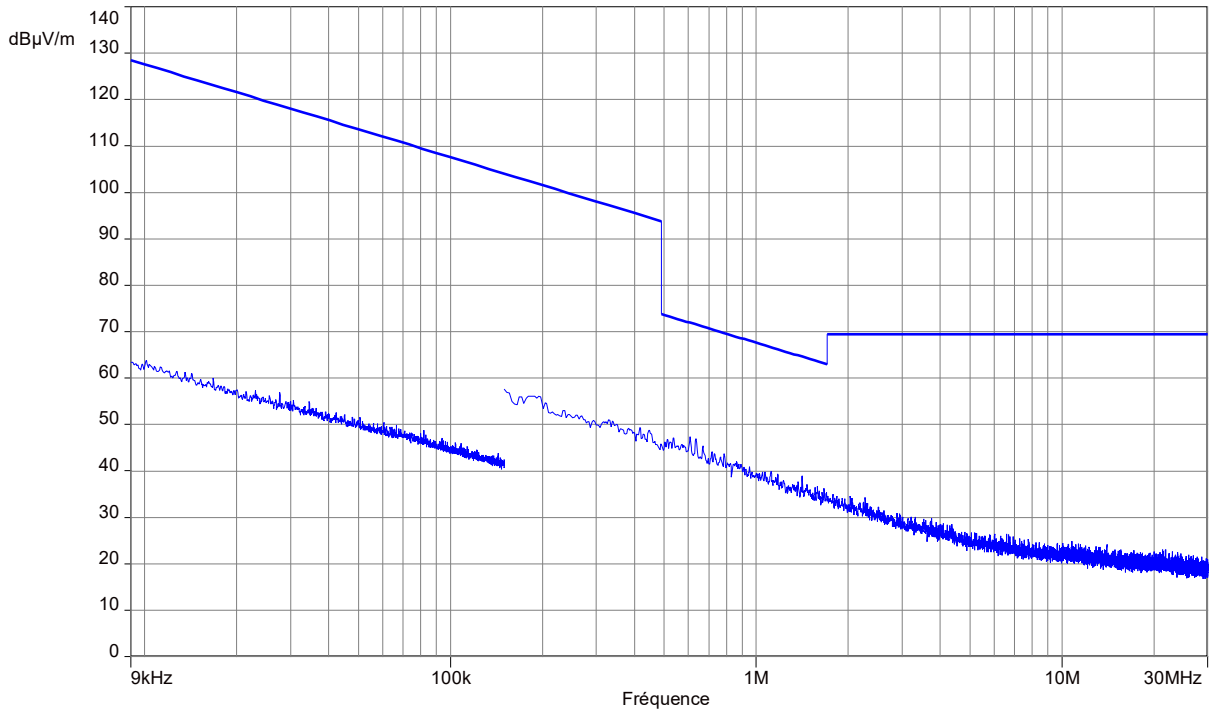
Frequency band investigated:	9kHz-30MHz
RBW:	200Hz (9kHz-150kHz) 9kHz (150kHz-30MHz)
Measurement distance:	10m
Limit:	FCC Part 15.205 - 15.209 / RSS-GEN
Final measurement detector:	Peak / Quasi-Peak / Average
Note:	CF: Correction factor = Antenna factor + Cable loss *1: Measure have been done at 10m distance and corrected according to requirements of 15.209.e) (M@30m = M@10m-19.1dB)

Tabulated Results for Unwanted emissions (30MHz-1GHz)										
FREQ	**Meter reading**	**Meter reading**	**Total factor**	**Field level**	**Field level**	**Pol**	**Antenna height**	**Table angle**	**Limit**	**Margin**
MHz	(QP) dBµV	(Pk) dBµV	dB	(QP) dBµV/m	(Pk) dBµV/m		cm	Degré	(QP) dBµV/m	dB
Margin < -10dB										
Supplementary information: Frequency list measured on the Open Area Test Site has been created with pre-scan results.										

Frequency band investigated:	30MHz-1GHz
RBW:	120kHz
Measurement distance:	3m
Limit:	FCC Part 15.205 - 15.209 / RSS-GEN
Final measurement detector:	Quasi-Peak
RESULT:	PASS
Field Strength Calculation:	The field strength (level) is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation is as follow: FS = RA + AF + CF – AG Where FS = Field Strength RA = Receiver Amplitude AF = Antenna Factor CF = Cable Factor AG = Amplifier Gain Total factor (dB) is AF + CF – AG Margin value = Emission level – Limit value

Tabulated Results for Unwanted emissions (1GHz-10GHz)					
FREQ (MHz)	**Field Strength 3m** (dBµV/m)	**Detector**	**Limit** (dBµV/m)	**Margin** (dBµV/m)	**Result**
DTS TEST MODE (500kHz)					
9030.0	59.7	Pk	74	-14.3	**Pass**
9030.0	46.0	Avg	54	-8.0	**Pass**
9078.0	59.7	Pk	74	-14.3	**Pass**
9078.0	46.0	Avg	54	-8.0	**Pass**
9142.0	59.6	Pk	74	-14.4	**Pass**
9142.0	46.0	Avg	54	-8.0	**Pass**
HYBRID TEST MODE (125kHz)					
9023.0	60.1	Pk	74	-13.9	**Pass**
9023.0	51.2	Avg	54	-2.8	**Pass**
9085.0	60.1	Pk	74	-13.9	**Pass**
9085.0	51.2	Avg	54	-2.8	**Pass**
9149.0	60.0	Pk	74	-14.0	**Pass**
9149.0	50.8	Avg	54	-3.2	**Pass**
RBW / VBW		1MHz / 3MHz			
Measurement distance:		3m			
Limit:		FCC Part 15.205, 15.209, 15.247 / RSS-Gen, RSS-247			
Final measurement detector:		Peak / CISPR Average			
RESULT:		PASS			
Notes:		(1): The field strength (level) is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation is as follow: FS = RA + AF + CF – AG Where FS = Field Strength RA = Receiver Amplitude AF = Antenna Factor CF = Cable Factor AG = Amplifier Gain Total factor (dB) is AF + CF – AG Margin value = Emission level – Limit value (2): All frequencies not specified have margin < -10dB (for peak and average detector)			

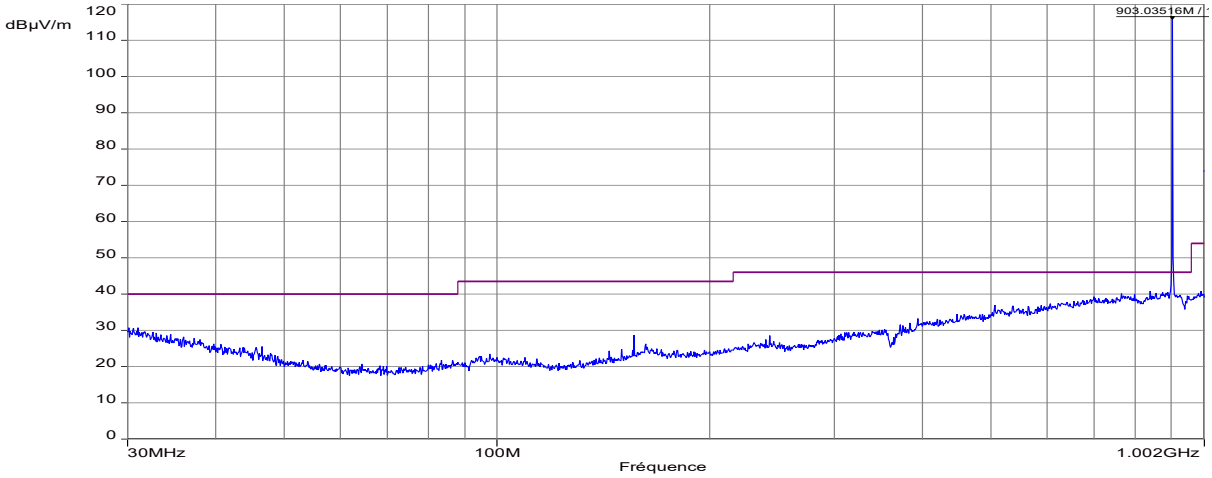
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 9kHz-30MHz / 3m / Parallel & Perpendicular antenna position / Transmit mode)

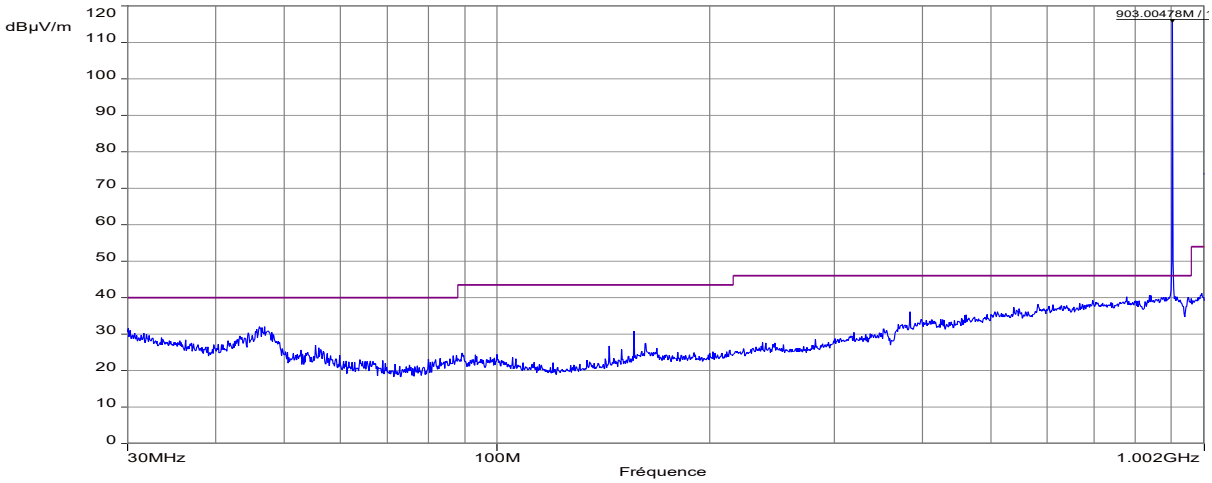


Notes: Pre-scan graph only for identification purpose.
Same result for transmit mode on all channels.

Frequency band investigated:	9kHz-30MHz
Unit :	dBµV/m
RBW :	200Hz (9kHz-150kHz) 9kHz (150kHz-30MHz)
Antenna polarization :	Parallel / Perpendicular to measurement axis
Measurement detector:	Peak

Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 30MHz-1GHz / 3m / Horizontal & Vertical / Low channel / DTS & Hybrid mode





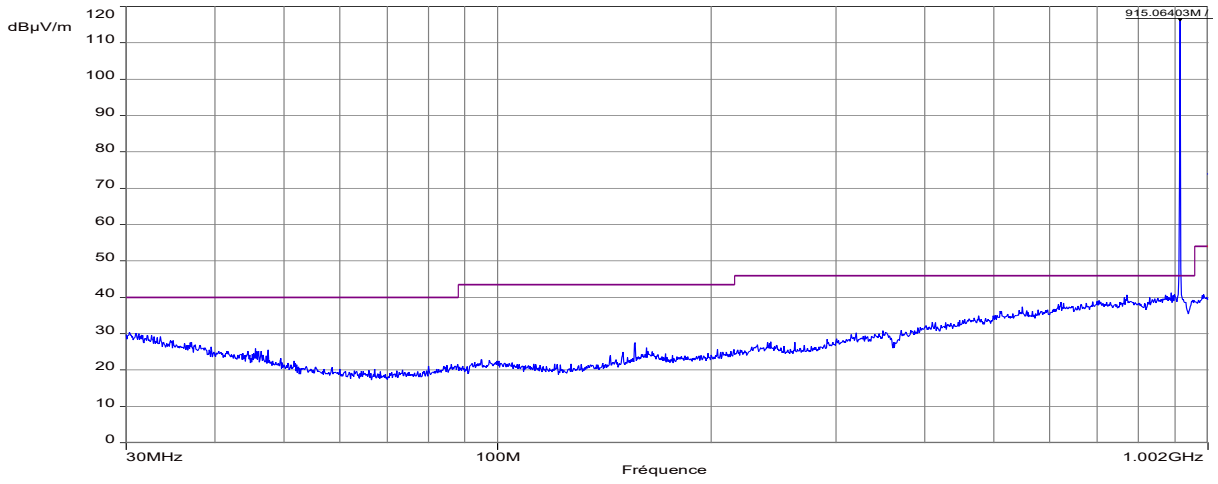
Note: Pre-scan graph only for identification purpose.
Same results for DTS or Hybrid modes

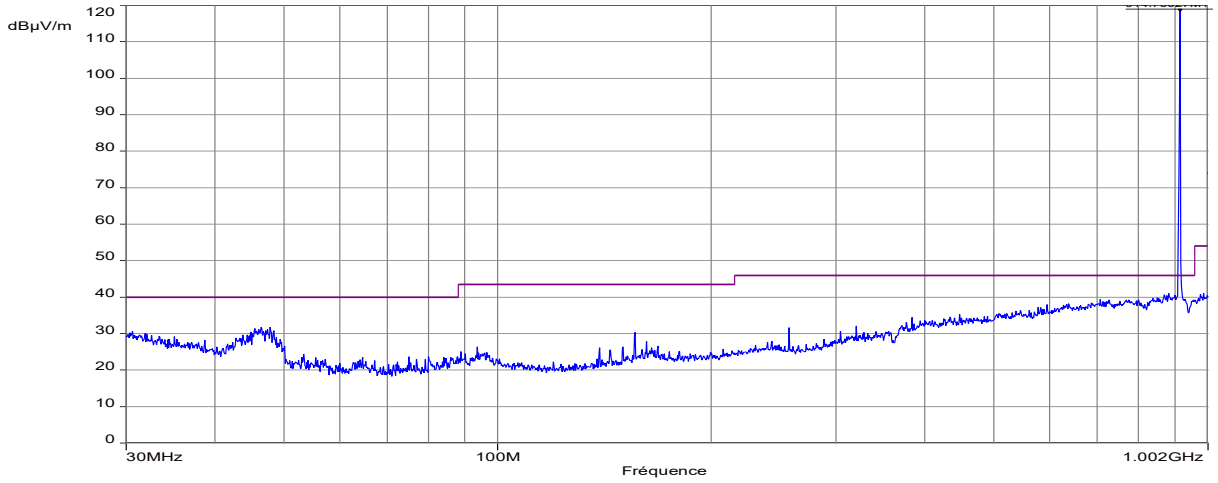
Frequency band investigated:	30MHz-1GHz
Unit :	dBµV/m
RBW :	100kHz
Antenna polarization :	Horizontal & Vertical
Limit:	FCC 15.247 / RSS-247
Measurement detector:	Peak

PEAK LIST FROM PRE-SCAN

Frequency (MHz)	Peak Level (dBµV/m)	Angle (°)	Limit (dBµV/m)	Polarization	Comments

Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 30MHz-1GHz / 3m / Horizontal & Vertical / High channel / DTS & Hybrid mode





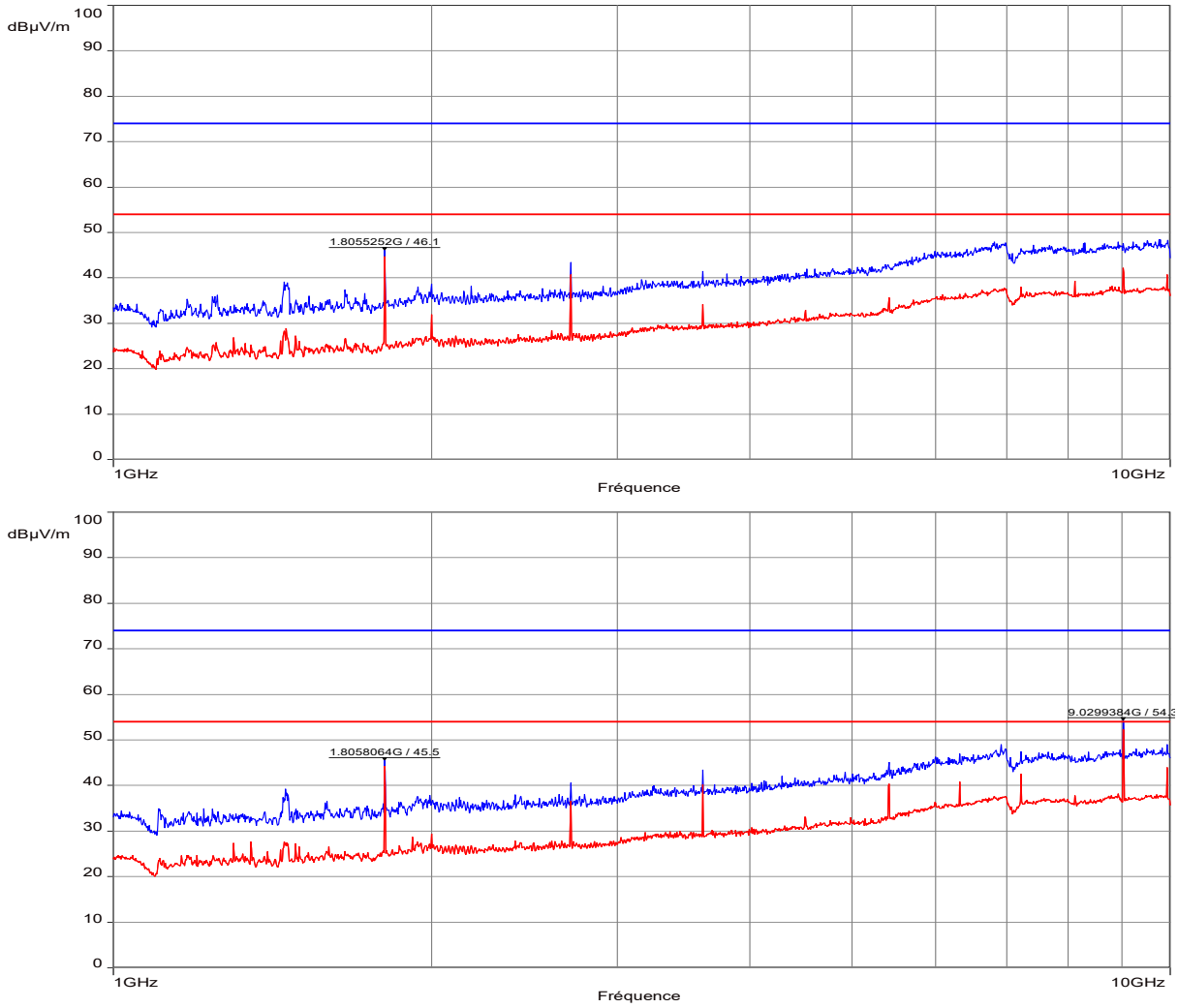
Note: Pre-scan graph only for identification purpose.
Same results for DTS or Hybrid modes

Frequency band investigated:	30MHz-1GHz
Unit :	dBµV/m
RBW :	100kHz
Antenna polarization :	Horizontal & Vertical
Limit:	FCC 15.247 / RSS-247
Measurement detector:	Peak

PEAK LIST FROM PRE-SCAN

Frequency (MHz)	Peak Level (dBµV/m)	Angle (°)	Limit (dBµV/m)	Polarization	Comments

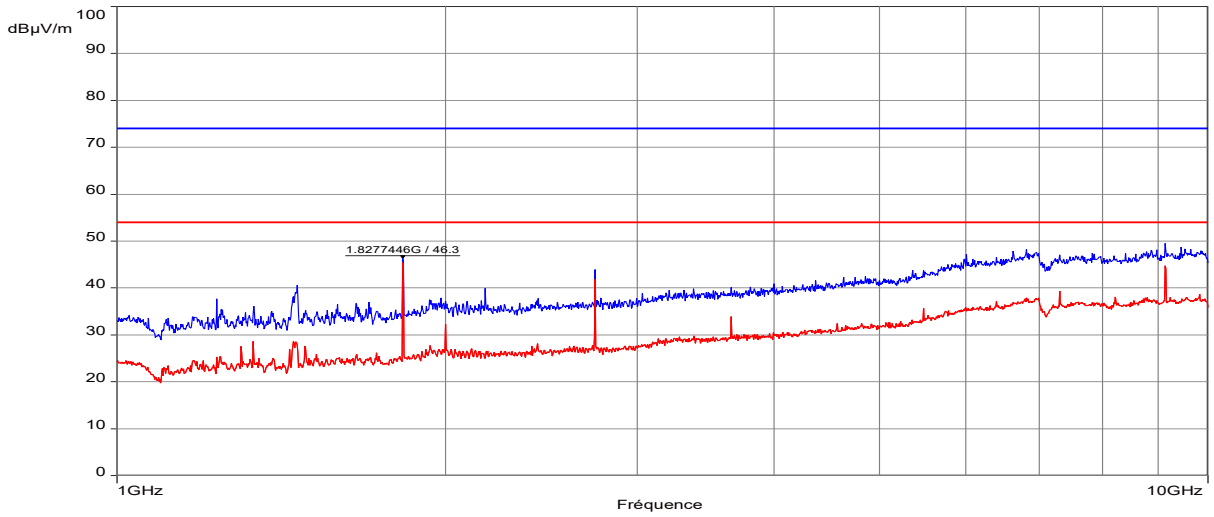
Graphical representation of Radiated Disturbance Measurement (Anechoic chamber pre-scan, 1GHz-10GHz / 3m / Horizontal & Vertical) – Low channel / DTS 500kHz mode

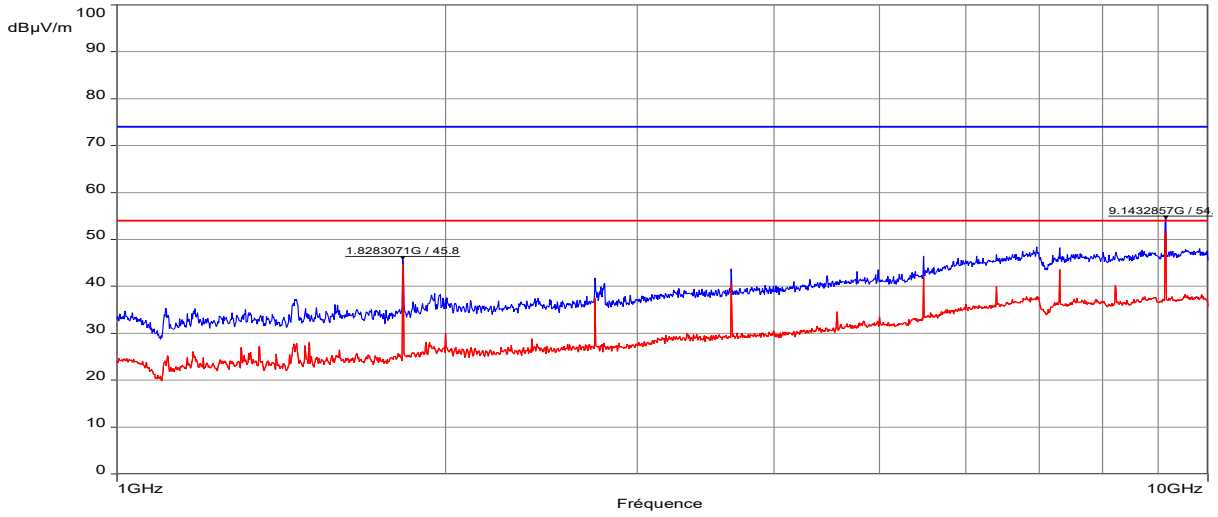


Note: Pre-scan graph only for identification purpose.

------ : Peak measure	------ : Average measure
Frequency band investigated:	1GHz-10GHz
Unit :	dBµV/m
RBW :	1MHz
Antenna polarization :	Horizontal & Vertical
Limit:	FCC 15.247 / RSS-247
Measurement detector:	Peak / Average

Graphical representation of Radiated Disturbance Measurement (Anechoic chamber pre-scan, 1GHz-10GHz / 3m / Horizontal & Vertical) – High channel / DTS 500kHz mode

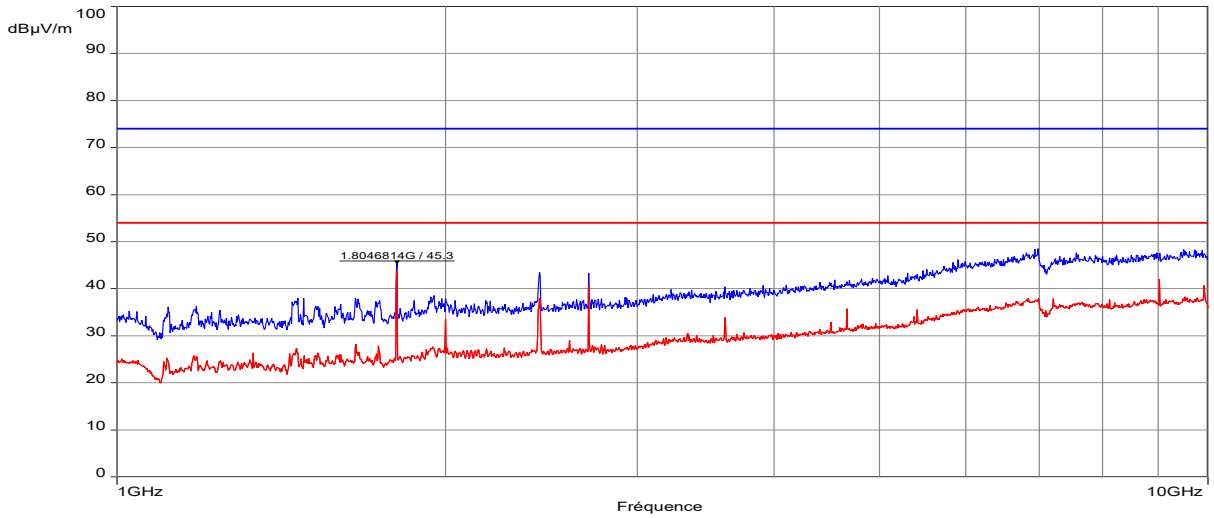


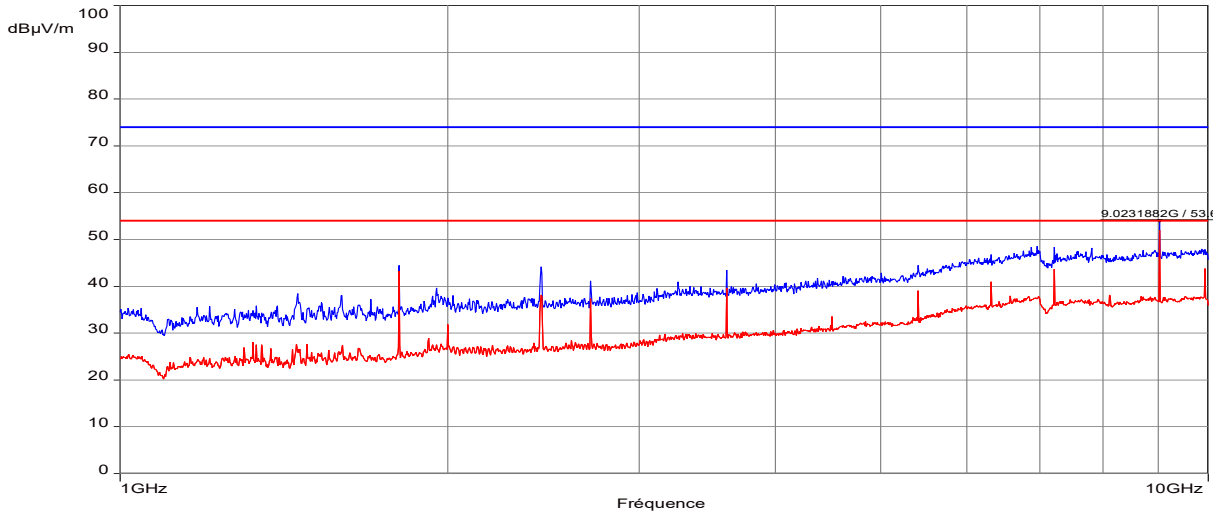


Note: Pre-scan graph only for identification purpose.

------ : Peak measure	------ : Average measure
Frequency band investigated:	1GHz-10GHz
Unit :	dBµV/m
RBW :	1MHz
Antenna polarization :	Horizontal & Vertical
Limit:	FCC 15.247 / RSS-247
Measurement detector:	Peak / Average

Graphical representation of Radiated Disturbance Measurement (Anechoic chamber pre-scan, 1GHz-10GHz / 3m / Horizontal & Vertical) – Low channel / Hybrid 125kHz mode

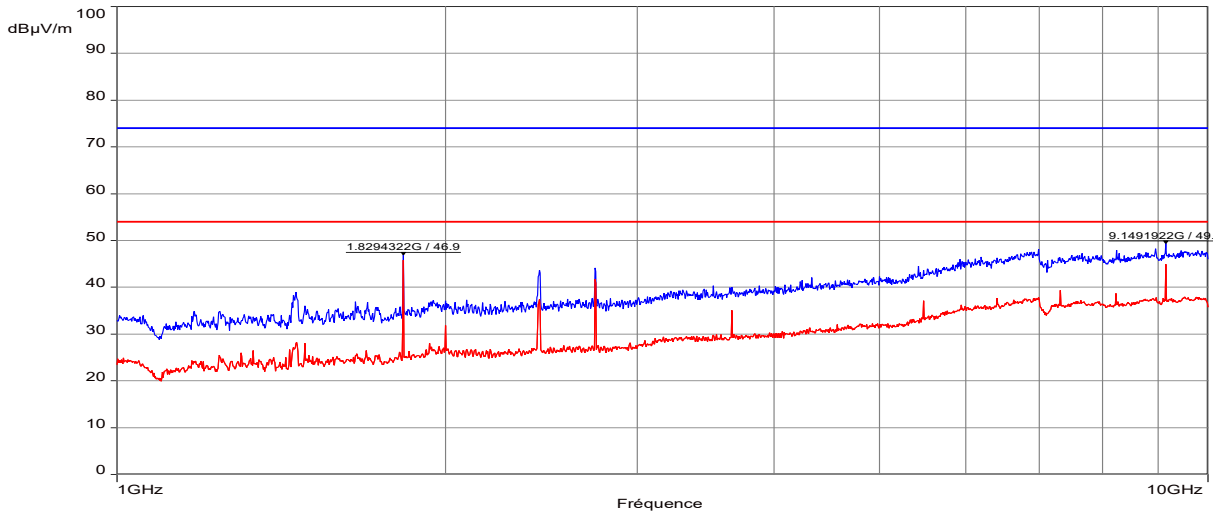


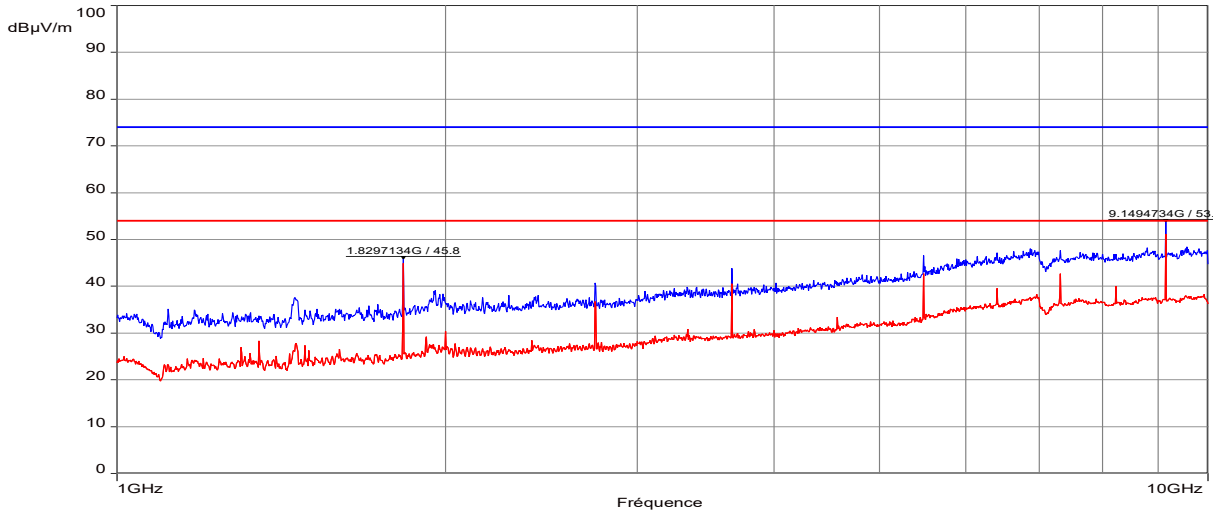


Note: Pre-scan graph only for identification purpose.

------ : Peak measure	------ : Average measure
Frequency band investigated:	1GHz-10GHz
Unit :	dBµV/m
RBW :	1MHz
Antenna polarization :	Horizontal & Vertical
Limit:	FCC 15.247 / RSS-247
Measurement detector:	Peak / Average

Graphical representation of Radiated Disturbance Measurement (Anechoic chamber pre-scan, 1GHz-10GHz / 3m / Horizontal & Vertical) – High channel / Hybrid 125kHz mode





Note: Pre-scan graph only for identification purpose.

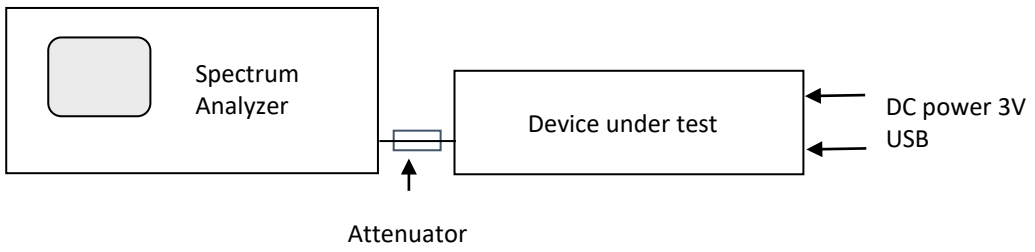
------ : Peak measure	------ : Average measure
Frequency band investigated:	1GHz-10GHz
Unit :	dBµV/m
RBW :	1MHz
Antenna polarization :	Horizontal & Vertical
Limit:	FCC 15.247 / RSS-247
Measurement detector:	Peak / Average

19. Occupied bandwidth (99%)

TEST: Occupied bandwidth (99%) / RSS-GEN		**Verdict**
Method: The setup is in an anechoic chamber. The spectrum analyzer is connected to the antenna port of the device under test. A conducted measurement is performed. The tested equipment is set to transmit operation with modulation on low, mid and high channels.		**Pass**
Laboratory Parameters:	Required prior to the test	During the test
Ambient Temperature	20 to 30 °C	22°C ± 2
Relative Humidity	25 to 70 %	40% ± 5
Supplementary information: Test location: SMEE. Test date: December 10th, 2018. Tested by L. CHAPUS		

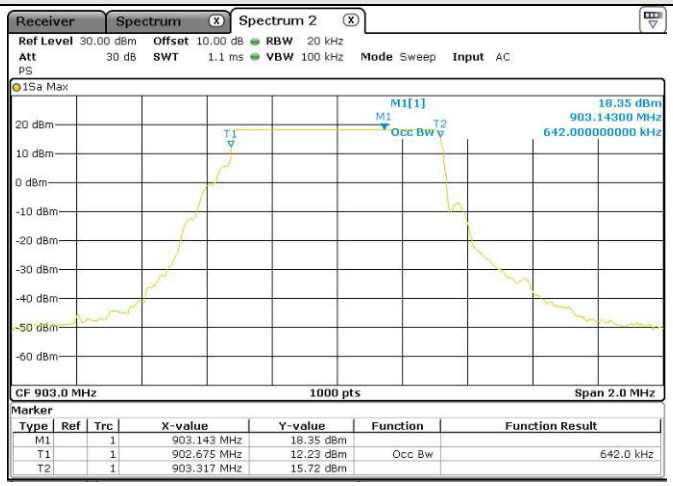
Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Attenuator	Mini-Circuit	BW-N10W5+	ATT-171-008	2018/4	2019/4
Spectrum analyzer	Rohde&Schwarz	ESRP	REC-151-002	2017/5	2019/5

Test Setup for conducted antenna port measurement

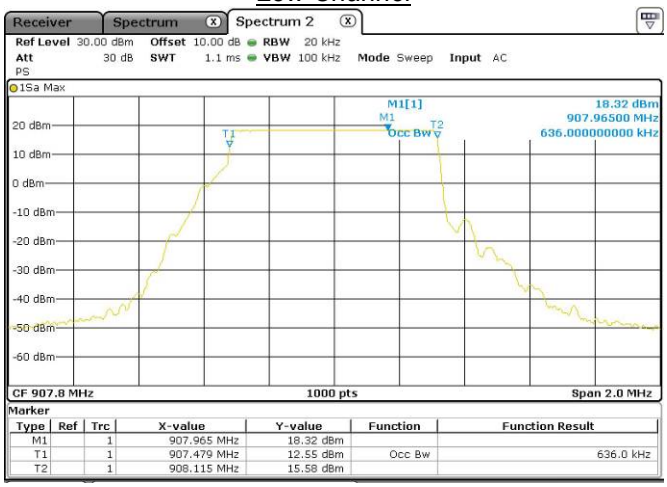


Tabulated Results for Occupied Bandwidth	
Frequency (MHz)	**99% Occupied Bandwidth** (kHz)
903.0 / DTS	642.0
907.8 / DTS	636.0
914.2 / DTS	638.0
902.3 / Hybrid	131.5
908.5 / Hybrid	132.0
914.9 / Hybrid	132.0

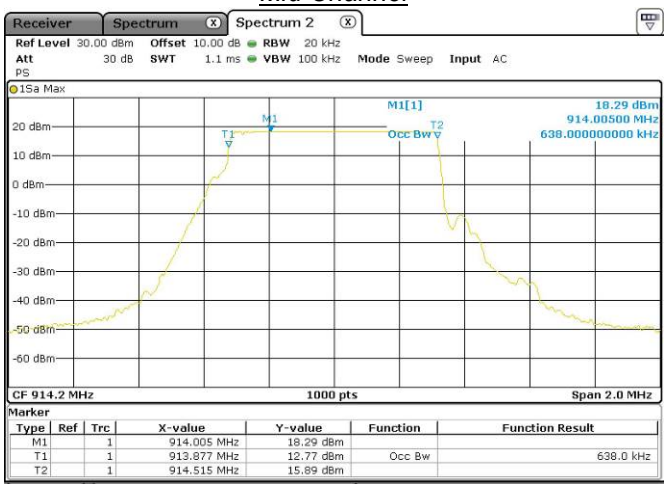
Graphical representation of Occupied Bandwidth (DTS / 500kHz mode)



Low Channel

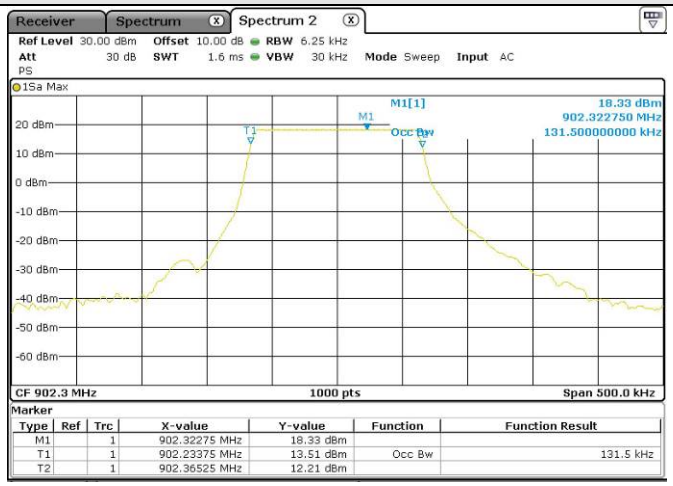


Mid Channel

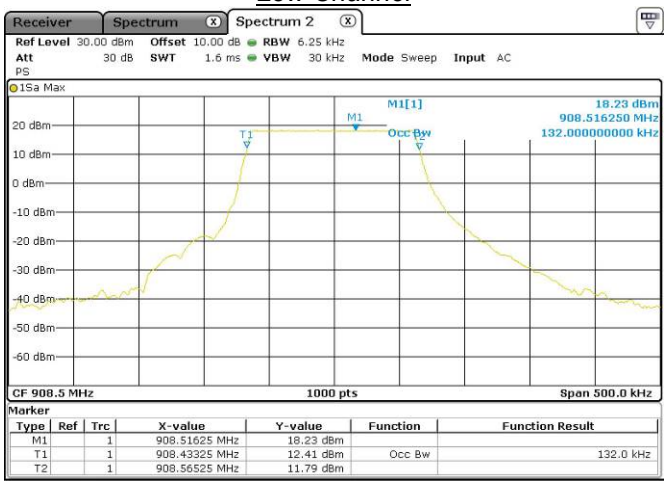


High Channel

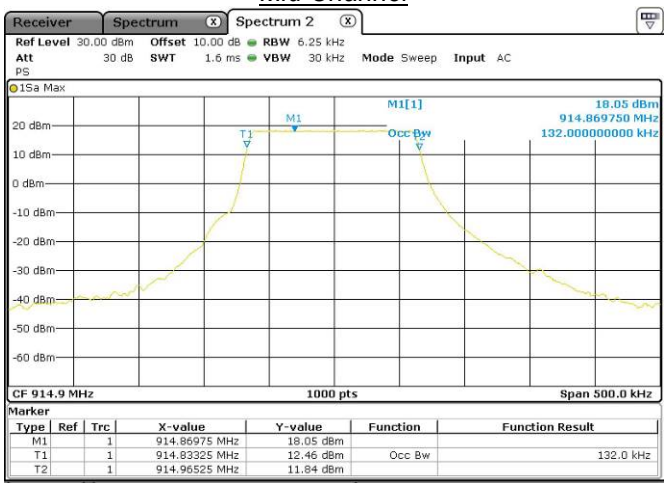
Graphical representation of Occupied Bandwidthv (Hybrid 125kHz)



Low Channel



Mid Channel



High Channel