

	Test Item	
Kind of test item:	WLAN module	
Model name:	SX-PCEAN2	
FCC ID:	YG3-SXPCEAN2	
IC:	4720B-SXPCEAN2	
Frequency:	DTS band 2400 MHz to 2483.5 MHz	Pulaisse
Technology tested:	WLAN	
Antenna:	2 External antennas	
Power supply:	2.805 V to 3.795 V DC, by Evaluation Board	
Temperature range:	0°C to +60°C	

This test report is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

Test report authorized:

Marco Bertolino Lab Manager Radio Communications & EMC

Test performed:

David Lang Lab Manager Radio Communications & EMC



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2 General information

2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. CTC advanced GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.

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This test report replaces the test report with the number 1-5326/17-01-02-B and dated 2018-07-06.

2.2 Application details

Date of receipt of order:	2017-11-21
Date of receipt of test item:	2017-11-21
Start of test:	2017-12-14
End of test:	2018-05-16
Person(s) present during the test:	-/-

2.3 Test laboratories sub-contracted

None

3 Test standard/s and references

Test standard	Date	Description
47 CFR Part 15	-/-	Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
RSS - 247 Issue 2	February 2017	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence - Exempt Local Area Network (LE- LAN) Devices
RSS - Gen Issue 4	November 2014	Spectrum Management and Telecommunications Radio Standards Specifications - General Requirements and Information for the Certification of Radio Apparatus

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Guidance	Version	Description
DTS: KDB 558074 D01	V04	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 American national standard for methods of measurement of radio-
ANSI C63.4-2014	-/-	noise emissions from low-voltage electrical and electronic equipment in the range of 9 kHz to 40 GHz
ANSI C63.10-2013	-/-	American national standard of procedures for compliance testing of unlicensed wireless devices
KDB 662911 D01	V02r01	Emissions Testing of Transmitters with Multiple Outputs in the Same Band

4 Test environment

Temperature	:	T _{nom} T _{max} T _{min}	+22 °C during room temperature tests No testing under extreme conditions required! No testing under extreme conditions required!
Relative humidity content	:		42 %
Barometric pressure	:		Not relevant for testing
Power supply	:	V _{nom} V _{max} V _{min}	24.0 V DC by external power supply No testing under extreme conditions required! No testing under extreme conditions required!



5 Test item

5.1 General description

Kind of test item	:	WLAN module						
Type identification	:	SX-PCEAN2						
HMN	:	-/-						
PMN	:	SX-PCEAN2						
HVIN	:	SX-PCEAN2						
FVIN	:	1.0.3.0.2	1.0.3.0.2					
S/N serial number	:	Rad. M7086839; Cond. M7086839						
HW hardware status		ZXE03263 (separation of	hw by changing of order of	code)				
SW software status	:	RF test software						
Frequency band	:	DTS band 2400 MHz to 2	2483.5 MHz					
Type of radio transmission Use of frequency spectrum		DSSS, OFDM						
Type of modulation	:	BPSK, QPSK, 16 – QAM, 64 – QAM						
Number of channels		11						
		variant of Omni-directiona	al and Directional Antenna					
		Antenna name ANT-OMNI-2459-02	Type Rod Antenna	Gain [dBi] 2.5 @ 2.4 GHz 5 @ 5 GHz				
		ANT-OMNI-2459-02	Rod Antenna	2.5 @ 2.4 GHz 5 @ 5 GHz				
				2.5 @ 2.4 GHz				
Antenna		ANT-OMNI-2459-02 ANT-OMNI-5900-01 RAD-ISM-2400-ANT-	Rod Antenna Rod Antenna	2.5 @ 2.4 GHz 5 @ 5 GHz 5 @ 5 GHz				
Antenna	:	ANT-OMNI-2459-02 ANT-OMNI-5900-01 RAD-ISM-2400-ANT- OMNI-2-1-RSMA RAD-ISM-2400-ANT-	Rod Antenna Rod Antenna Rod Antenna	2.5 @ 2.4 GHz 5 @ 5 GHz 5 @ 5 GHz 2 @ 2.4 GHz				
Antenna		ANT-OMNI-2459-02 ANT-OMNI-5900-01 RAD-ISM-2400-ANT- OMNI-2-1-RSMA RAD-ISM-2400-ANT- VAN-3-0-RSMA RAD-ISM-2400-ANT-	Rod Antenna Rod Antenna Rod Antenna Omni Ceiling Antenna	2.5 @ 2.4 GHz 5 @ 5 GHz 5 @ 5 GHz 2 @ 2.4 GHz 3 @ 2.4 GHz				
Antenna	:	ANT-OMNI-2459-02 ANT-OMNI-5900-01 RAD-ISM-2400-ANT- OMNI-2-1-RSMA RAD-ISM-2400-ANT- VAN-3-0-RSMA RAD-ISM-2400-ANT- OMNI-6-0 ANT-DIR-2459-01 For the purpose of testing antenna is considered: - Omni Ceiling Ant - Rod Antenna (6 of	Rod Antenna Rod Antenna Rod Antenna Omni Ceiling Antenna Omni Ceiling Antenna Directional g the antenna with the high enna (3 dBi) dBi)	2.5 @ 2.4 GHz 5 @ 5 GHz 5 @ 5 GHz 2 @ 2.4 GHz 3 @ 2.4 GHz 6 @ 2.4 GHz 9 @ 2.4 GHz 9 @ 5 GHz				
	:	ANT-OMNI-2459-02 ANT-OMNI-5900-01 RAD-ISM-2400-ANT- OMNI-2-1-RSMA RAD-ISM-2400-ANT- VAN-3-0-RSMA RAD-ISM-2400-ANT- OMNI-6-0 ANT-DIR-2459-01 For the purpose of testing antenna is considered: - Omni Ceiling Ant - Rod Antenna (6 o - Directional Anter	Rod Antenna Rod Antenna Rod Antenna Omni Ceiling Antenna Omni Ceiling Antenna Directional g the antenna with the high enna (3 dBi) dBi) ina (9 dBi)	2.5 @ 2.4 GHz 5 @ 5 GHz 5 @ 5 GHz 2 @ 2.4 GHz 3 @ 2.4 GHz 6 @ 2.4 GHz 9 @ 2.4 GHz 9 @ 5 GHz				
Antenna Power supply Temperature range	:	ANT-OMNI-2459-02 ANT-OMNI-5900-01 RAD-ISM-2400-ANT- OMNI-2-1-RSMA RAD-ISM-2400-ANT- VAN-3-0-RSMA RAD-ISM-2400-ANT- OMNI-6-0 ANT-DIR-2459-01 For the purpose of testing antenna is considered: - Omni Ceiling Ant - Rod Antenna (6 of	Rod Antenna Rod Antenna Rod Antenna Omni Ceiling Antenna Omni Ceiling Antenna Directional g the antenna with the high enna (3 dBi) dBi) ina (9 dBi)	2.5 @ 2.4 GHz 5 @ 5 GHz 2 @ 5 GHz 2 @ 2.4 GHz 3 @ 2.4 GHz 6 @ 2.4 GHz 9 @ 2.4 GHz 9 @ 5 GHz				

5.2 Additional information

The content of the following annexes is defined in the QA. It may be that not all of the listed annexes are necessary for this report, thus some values in between may be missing.

Test setup- and EUT-photos are included in test report:

1-5326/17-01-01_AnnexA 1-5326/17-01-01_AnnexB 1-5326/17-01-01_AnnexD



6 Description of the test setup

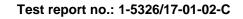
Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements with other calibrated test systems or effective verifications. Weekly chamber inspections and range calibrations are performed. Where possible, RF generating and signaling equipment as well as measuring receivers and analyzers are connected to an external high-precision 10 MHz reference (GPS-based or rubidium frequency standard).

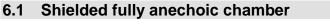
In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

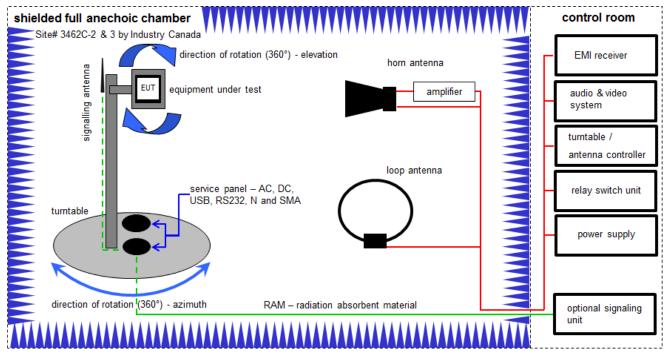
Agenda: Kind of Calibration

- k calibration / calibrated
- ne not required (k, ev, izw, zw not required)
- ev periodic self verification
- Ve long-term stability recognized
- vlkl! Attention: extended calibration interval
- NK! Attention: not calibrated

- EK limited calibration
- zw cyclical maintenance (external cyclical maintenance)
- izw internal cyclical maintenance
- g blocked for accredited testing
- *) next calibration ordered / currently in progress







Measurement distance: horn antenna 3 meter; loop antenna 3 meter

FS = UR + CA + AF (FS-field strength; UR-voltage at the receiver; CA-loss of the signal path; AF-antenna factor)

Example calculation:

 $FS [dB\mu V/m] = 40.0 [dB\mu V/m] + (-35.8) [dB] + 32.9 [dB/m] = 37.1 [dB\mu V/m] (71.61 \mu V/m)$

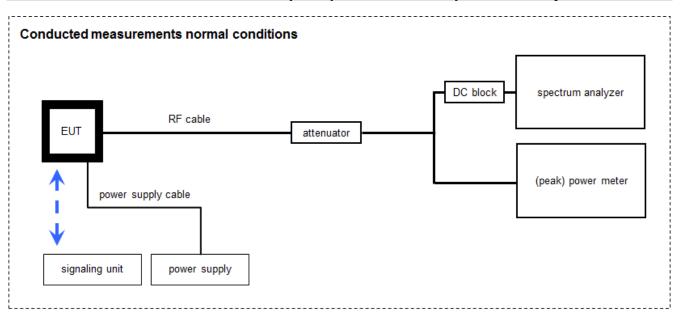
Equipment table:

No.	Lab / Item	Equipment	Туре	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	8812-3088	300001032	vIKI!	07.07.2017	06.07.2019
2	A+B	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2920A04590	300001041	vIKI!	14.12.2017	13.12.2020
3	А	Band Reject Filter	WRCG2400/2483- 2375/2505-50/10SS	Wainwright	26	300003792	ne	-/-	-/-
4	A+B	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000032	300004510	ne	-/-	-/-
5	A+B	Computer	Intel Core i3 3220/3,3 GHz, Prozessor		2V2403033A54 21	300004591	ne	-/-	-/-
6	A+B	NEXIO EMV- Software	BAT EMC V3.16.0.49	EMCO		300004682	ne	-/-	-/-
7	A+B	Anechoic chamber		TDK		300003726	ne	-/-	-/-
8	A+B	EMI Test Receiver 9kHz-26,5GHz	ESR26	R&S	101376	300005063	k	14.12.2017	13.12.2018
9	А	RF Amplifier	AFS4-00100800-28- 20P-4-R	MITEQ	2008992	300005204	ne	-/-	-/-
10	В	Active Loop Antenna 9 kHz to 30 MHz	6502	EMCO	2210	300001015	k	07.07.2017	06.07.2019

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6.2 Conducted measurements with peak power meter & spectrum analyzer



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OP = AV + CA

(OP-output power; AV-analyzer value; CA-loss signal path)

Example calculation:

OP [dBm] = 6.0 [dBm] + 11.7 [dB] = 17.7 [dBm] (58.88 mW)

Equipment table:

No.	Lab / Item	Equipment	Туре	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	PTL	Power Meter	NRV-Z32	Rohde & Schwarz	849745/016	-/-	k	2017-02-24	2018-02-23
2	А	DC Power Supply 0 - 32V	1108-32	Heiden Elektronik	001702	300001392	vIKI!	26.01.2017	25.01.2020
3	A	PC-WLAN Tester	Intel Core i3 3220/3,3 GHz, Prozessor		2V2403033A45 23	300004589	ne	-/-	-/-
4	А	Teststand	Teststand Custom Sequence Editor	National Instruments GmbH		300004590	ne	-/-	-/-
5	A	Power Sensor	NRP-Z81	R&S	100010	300003780	k	26.01.2017	25.01.2019
6	А	RF-Cable	ST18/SMAm/SMAm/ 60	Huber & Suhner	Batch no. 606844	400001181	ev	-/-	-/-
7	А	DC-Blocker 0.1-40 GHz	8141A	Inmet		400001185	ev	-/-	-/-
8	А	Coax Attenuator 10 dB 2W 0-40 GHz	MCL BW-K10- 2W44+	Mini Circuits		400001186	ev	-/-	-/-
9	В	Signal Analyzer 40 GHz	FSV40	R&S	101353	300004819	k	12.12.2017	11.12.2019
10	В	RF-Cable WLAN- Tester Port 0	ST18/SMAm/SMAm/ 48	Huber & Suhner	Batch no. 1273777	400001249	ev	-/-	-/-
11	с	PXA Spectrum Analyzer 3Hz to 50GHz	N9030A PXA Signal Analyzer	Agilent Technologies	US51350267	300004338	k	05.03.2018	04.03.2019

*PTL = Phoenix Test Lab



7 Sequence of testing

7.1 Sequence of testing radiated spurious 9 kHz to 30 MHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, it is placed on a table with 0.8 m height.
- If the EUT is a floor standing device, it is placed directly on the turn table.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 3 m (see ANSI C 63.4) see test details.
- EUT is set into operation.

Premeasurement*

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna height is 1 m.
- At each turntable position the analyzer sweeps with positive-peak detector to find the maximum of all emissions.

Final measurement

- Identified emissions during the pre-measurement are maximized by the software by rotating the turntable from 0° to 360°.
- Loop antenna is rotated about its vertical axis for maximum response at each azimuth about the EUT. (For certain applications, the loop antenna plane may also need to be positioned horizontally at the specified distance from the EUT)
- The final measurement is done in the position (turntable and elevation) causing the highest emissions with quasi-peak (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. A plot with the graph of the premeasurement and the limit is stored.

*)Note: The sequence will be repeated three times with different EUT orientations.



7.2 Sequence of testing radiated spurious 1 GHz to 18 GHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a 2-axis positioner with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed directly on the turn table.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 3 m (see ANSI C 63.4) see test details.
- EUT is set into operation.

Premeasurement

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height is 1.5 m.
- At each turntable position and antenna polarization the analyzer sweeps with positive peak detector to find the maximum of all emissions.

Final measurement

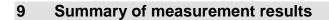
- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4.
- Based on antenna and turntable positions at which the peak values are measured the software maximizes the peaks by rotating the turntable from 0° to 360°. This measurement is repeated for different EUT-table positions (0° to 150° in 30°-steps) and for both antenna polarizations.
- The final measurement is done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and RMS detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is stored.



8 Measurement uncertainty

Measurement uncertainty					
Test case	Uncertainty				
Antenna gain	± 3 dB				
Power spectral density	± 1.5 dB				
DTS bandwidth	± 100 kHz (depends on the used RBW)				
Occupied bandwidth	± 100 kHz (depends on the used RBW)				
Maximum output power	± 1.5 dB				
Detailed spurious emissions @ the band edge - conducted	± 1.5 dB				
Band edge compliance radiated	± 3 dB				
Spurious emissions conducted	± 3 dB				
Spurious emissions radiated below 30 MHz	± 3 dB				
Spurious emissions radiated 30 MHz to 1 GHz	± 3 dB				
Spurious emissions radiated 1 GHz to 12.75 GHz	± 3.7 dB				
Spurious emissions radiated above 12.75 GHz	± 4.5 dB				
Spurious emissions conducted below 30 MHz (AC conducted)	± 2.6 dB				

Test report no.: 1-5326/17-01-02-C



\boxtimes	No deviations from the technical specifications were ascertained									
	There were devia			cations asc	ertained					
\boxtimes	This test report is The content and			ses are list	ed below	<i>.</i>				
TC Identifier	Descr	ption	Verdi	ct	Dat	e			emark	
RF-Testing	CFR P RSS - 247		See ta	ble!	2018-0	8-24	a	Reduc accordi spec Module	tomer ns.	
Test specification clause	Test case	Guideline	Temperature conditions	Power source voltages	Mode	с	C NC NA NP		Remark	
§15.247(b)(4) RSS - 247 / 5.4 (f)(ii)	Antenna gain	-/-	Nominal	Nominal	DSSS	A	s per da	ata shee	et!	-/-
§15.35	Duty cycle	-/-	Nominal	Nominal	DSSS OFDM		-,	/-		-/-
§15.247(e) RSS - 247 / 5.2 (b)	Power spectral density	KDB 558074 DTS clause: 10.2	Nominal	Nominal	DSSS OFDM					-/-
§15.247(a)(2) RSS - 247 / 5.2 (a)	DTS bandwidth	KDB 558074 DTS clause: 8.1	Nominal	Nominal	DSSS OFDM					-/-
RSS Gen clause 4.6.1	Occupied bandwidth	-/-	Nominal	Nominal	DSSS OFDM					-/-
§15.247(b)(3) RSS - 247 / 5.4 (d)	Maximum output power	KDB 558074 DTS clause: 9.1.2	Nominal	Nominal	DSSS OFDM	\boxtimes				-/-
§15.247(d) RSS - 247 / 5.5	Detailed spurious emissions @ the band edge – cond.	-/-	Nominal	Nominal	DSSS OFDM	\boxtimes				-/-
§15.205 RSS - 247 / 5.5 RSS - Gen	Band edge compliance cond.	KDB 558074 DTS clause: 13.3.2 and clause 12.2.2	Nominal	Nominal	DSSS OFDM					-/-
§15.247(d) RSS - 247 / 5.5	TX spurious emissions cond. (Non-restricted bands)	KDB 558074 DTS clause: 11.1 & 11.2 11.3	Nominal	Nominal	DSSS OFDM				\boxtimes	*1
§15.209(a) RSS-Gen	TX spurious emissions. below 30 MHz	-/-	Nominal	Nominal	DSSS OFDM	\boxtimes				-/-
§15.247(d) RSS - 247 / 5.5 RSS-Gen	TX spurious emissions 30 MHz to 1 GHz	-/-	Nominal	Nominal	DSSS OFDM	\boxtimes				-/-
§15.247(d) RSS - 247 / 5.5 RSS-Gen	TX spurious emissions above 1 GHz	-/-	Nominal	Nominal	DSSS OFDM	\boxtimes				*2
§15.109 RSS-Gen	RX spurious emissions rad. 30 MHz to 1 GHz	-/-	Nominal	Nominal	RX / idle					*1
§15.109 RSS-Gen	RX spurious emissions above 1 GHz	-/-	Nominal	Nominal	RX / idle					*1
§15.107(a) §15.207	Conducted emissions < 30 MHz	-/-	Nominal	Nominal	DSSS OFDM					*1





Notes:

С	Compliant	NC	Not compliant	NA	Not applicable	NP	Not performed
---	-----------	----	---------------	----	----------------	----	---------------

*1 As per module report

*² Restricted band measurements are performed in a conducted way. Emissions exceeding the applicable limit were verified by repeating a single frequency measurement in a radiated measurement, considering the representative set of antennas (see section 10 – special test descriptions).

The radiated measurement was chosen to show compliance since the applicable correction factor accounting for the antenna gain is not known for frequencies that are outside the useful band.

10 Additional comments

Reference documents:	Module Report: F161629E1_2ndVersion.pdf issued by Phoenix TESTLAB, 2017-04-18.
	Antenna specification: ANT-DIR-2459-01-2701186_expanded ANT-OMNI-2459-02–2701408_Datasheet Radiation Pattern – Preliminary ANT-OMNI-5900-01-2701347_expanded RAD-ISM-2400-ANT-OMNI-2-1-RSMA-2701362 RAD-ISM-2400-ANT-OMNI-6-0-2885919 RAD-ISM-2400-ANT-VAN-3-0-RSMA – 2701358
Special test descriptions:	For any declared antenna type respectively structure the antenna with the highest gain was chosen to represent the worst case scenario for radiated emission measurements.
	For conducted measurements two operating modes are considered: OP1: Single antenna operation (for 9dBi Directional-Antenna) OP2: Dual antenna operation (for 6dBi Omni-Antennas) Hence, a 9dB correction factor was used to account for antenna gain (see 12.6).

Configuration descriptions: As provided by manufacturer:

Modulation	Data rate / Modulation	Target Power per Chain (dBm)							
	scheme	2412 MHz	2437 MHz	2462 MHz					
DSSS	1 Mbit/s	12.5	14.5	11.0					
OFDM (20 MHz)	9 Mbit/s	11.5	13.0	11.5					
		2422 MHz	2437 MHz	2452 MHz					
OFDM (40 MHz)	MCS0	5.0	11.0	3.5					

Note: Settings applicable for dual and single-chain operation.



11 Additional EUT parameter

Test mode:		No test mode available Iperf was used to ping another device with the largest support packet size
		Test mode available Special software is used. EUT is transmitting pseudo random data by itself
Modulation types:	\boxtimes	Wide Band Modulation (None Hopping – e.g. DSSS, OFDM)
		Frequency Hopping Spread Spectrum (FHSS)
Antennas and transmit operating modes:		 Operating mode 1 (single antenna) Equipment with 1 antenna, Equipment with 2 diversity antennas operating in switched diversity mode by which at any moment in time only 1 antenna is used, Smart antenna system with 2 or more transmit/receive chains, but operating in a mode where only 1 transmit/receive chain is used)
	\boxtimes	 Operating mode 2 (multiple antennas, no beamforming) Equipment operating in this mode contains a smart antenna system using two or more transmit/receive chains simultaneously but without beamforming.
		 Operating mode 3 (multiple antennas, with beamforming) Equipment operating in this mode contains a smart antenna system using two or more transmit/receive chains simultaneously with beamforming. In addition to the antenna assembly gain (G), the beamforming gain (Y) may have to be taken into account when performing the measurements.



12 Measurement results

12.1 Testability check

Description:

Comparison of the first assessment with the current product based on the performance and decision of the test ability.

Measurement:

Measurement parameters							
Peak Po	wer Meter						
Test setup	See chapter 6.2 - PTL						
Measurement uncertainty	See chapter 8						

Limits:

Main	report	value	-2 dB	/ +1	dB
IVIAIII	Tepon	value	-2 uD	/ -	uD

Results:

T _{nom}	V _{nom}	lowest channel	middle channel	highest channel
		DSSS mode (Antenna	0)	
	oower / dBm 29E1_2ndVersion	12.7	14.8	10.4
	oower / dBm k – delta sample	12.5	14.5	10.7
	OFD	M (20 MHz mode (Ante	enna 1)	
	oower / dBm 29E1_2ndVersion	20.5	22.4	18.8
	oower / dBm k – delta sample	20.6	22.7	18.4



12.2 Antenna gain

As declared by manufacturer (see section 5.1).

The gain of two different antenna configurations is considered in this test report:

The directional 9dBi antenna is considered for single-chain operation only.

The omni-directional 6dBi antenna is considered for dual-chain operation to represent all stated omni antennas with less than 6dBi.

12.3 Identify worst case data rate

Description:

All modes of the module will be measured with an average power meter or spectrum analyzer to identify the maximum transmission power.

In further tests only the identified worst case modulation scheme or bandwidth will be measured and this mode is used as representative mode for all other modulation schemes.

Results:

Modulation scheme / bandwidth									
DSSS / b – mode	1 Mbit/s								
OFDM / g – mode	9 Mbit/s								
OFDM / n HT20 – mode	MCS0								
OFDM / n HT40 – mode	MCS0								

Note: Worst case data rate or modulation scheme according Module Report F161629E1_2ndVersion



12.4 Duty cycle

Description:

Measurement of the timing behavior.

Measurement:

Measurement parameter								
Detector	Peak							
Sweep time	Depends on the signal see plot							
Resolution bandwidth	10 MHz							
Video bandwidth	10 MHz							
Trace mode	Max hold							
Test setup	See chapter 6.2 - B							
Measurement uncertainty	See chapter 8							

Limits:

FCC	IC							
No limitation!								

Results:

T _{nom}	V _{nom}	lowest channel	middle channel	highest channel
DSSS / k	o – mode	99.7 % / 0.0 dB	99.7 % / 0.0 dB	99.7 % / 0.0 dB
OFDM /	g – mode	96.8 % / 0.1 dB	96.8 % / 0.1 dB	96.8 % / 0.1 dB
OFDM / n H	T20 – mode	94.4 % / 0.2 dB	94.4 % / 0.2 dB	94.4 % / 0.2 dB
OFDM / n H	T40 – mode	94.8 % / 0.2 dB	94.8 % / 0.2 dB	94.8 % / 0.2 dB

Note: The highest correction factor of 0.23dB is applied to the Reference Level Offset during the conducted measurements if AVG is used.



Plots:

Duty cycle and correction factor (example for one channel & one antenna port):

Plot 1: duty cycle of the transmitter; b – mode

Spectr	um												
Ref Lev Att SGL Co		40	Bm dB = SWT 24. TDF			10 MHz 10 MHz							L
⊖1Pk Clr	rw												
			M1					M	1[1]				11.65 dBm
10 dBm-								D:	2[1]			D3	<u>5.1187 ms</u> -31.72 dB
0 dBm—	_										-		16.4687 ms
-10 dBm	-										_	_	
-20 dBm	-												
-30 dBm	-				_					 	_		
-40 dBm	-									 	_		
-50 dBm	-									 	_		
-60 dBm	-									 			
-70 dBm	-									 			
CF 2.41	 12 GH	z				1000) pts						2.47 ms/
Marker													
	Ref	Trc	X-value		Y	-value		Func	tion	Fu	nction	Resu	lt
M1		1		.87 ms		11.65 dE							
D2 D3	M1 M1	1		87 ms 35 ms		-31.72							
][R	eady		0.400		06.03.2018

Date: 6.MAR.2018 12:30:24

Plot 2: duty cycle of the transmitter; g – mode

Spect	rum												
Ref Le	vel 2	4.42 dE	3m		RBV	10 MHz							
Att		40	dB 🔵 SWT 4.2	2 ms 👄	νвν	V 10 MHz							
SGL Co	unt 1	/1	TDF										
●1Pk Cl													
20 dBm								M	L[1]				10.43 dBm
10 dBm	diptor	lyrhhad a	hippy	unun jurtij D:	glim	yp-th-t-nththeyu	ww	wwwD2	broghton 1 [1]	vh 	aller Population	montalitationshafty	-34.51 dB 1.36282 ms
0 dBm—													
-10 dBm	۱ <u> </u>												
- <mark>8</mark> 0 dBm										h			
-30 dBm	<u>+</u>												
-40 dBm	<u>ا</u> ر												
-50 dBm	<u>ا</u> ر												
-60 dBm	n												
-70 dBm	η												
CF 2.4	37 GH	Iz	1	I		1000	pts				-	1	422.81 µs/
Marker													
Туре	Ref	Trc	X-value	,		Y-value		Funct	ion		Fun	ction Res	sult
M1		1		ł.27 μs		10.43 dB							
D2	M1	1		282 ms		-34.51 (
D3	M1	1	1.40	937 ms		1.10	dB						
								R	eady			1,00	06.03.2018

Date: 6.MAR.2018 13:02:00



Plot 3: duty cycle of the transmitter; n – mode

Spectru	m								E
Ref Leve			_	BW 10 MHz					
Att		dB 👄 SWT 4.2	ms 👄 V	'BW 10 MHz					
SGL Cour		TDF							
⊖1Pk Clrw									
20 dBm-		1.			M1	[1]			10.43 dBm
հ <u>Manuhili</u> 10 dBm—	phonetypelite	white	www.w/1403l	theopy and the second second	<u></u> D2	(1)	allertraterilere	modulumber	-34.51 dB 1.36282 ms
0 dBm							1	+	1.36282 ms
-10 dBm—									
-ap dBm—							U I		
-30 dBm—			Δ						
-40 dBm—									
-50 dBm—									
-60 dBm—									
-70 dBm—	-								+
CF 2.437	ĠHz	I		1000 p	ts		1	1	422.81 µs/
Marker									
	ef Trc	X-value		Y-value	Funct	ion	Fur	nction Resu	lt
M1	1		.27 µs	10.43 dBm					
	M1 1 M1 1		82 ms 37 ms	-34.51 dB 1.10 dB					
					Re	e a d y	111111	4,40	06.03.2018

Date: 6.MAR.2018 13:02:00

Plot 4: duty cycle of the transmitter; n40 – mode

Spectrum						
Ref Level			3W 10 MHz			
Att		B 👄 SWT 2 ms 👄 V	BW 10 MHz			
SGL Count	1/1	TDF				
●1Pk Clrw						
				M1[1]		6.76 dBm
BONG BANK	, հեն հեր հերին հեն հեն հեն հեն հեն հեն հեն հեն հեն հե	udun yan Minaka Mina	and the straight straight the straight	Here and the state	where a where the second	Munu 419 世紀 -28.38 dB
· · ·				D2 12 1		
0 dBm						631.53 μs
-10 dBm						
-20 dBm		Hu I		1 Aline		101/
-30 dBm						
-30 0611						
-40 dBm						
io abiii						
-50 dBm						
-60 dBm						
-70 dBm						
CF 2.437 G	Hz		1000 p	is		201.56 µs/
Marker						
Type Ref	Trc	X-value	Y-value	Function	Functi	on Result
M1	1	593.19 µs	6.76 dBm			
D2 M:		631.53 µs	-28.30 dB			
D3 M:	1 1	667.84 µs	-0.13 dB			
				Ready		06.03.2018

Date: 6.MAR.2018 13:42:53



12.5 Maximum output power

Description:

Measurement of the maximum conducted peak output power. The measurements are performed using the data rate identified in the previous chapter.

Measurement:

Measurement parameter					
According to DTS clause: 9.1.2					
	Peak power meter				
Test setup	See chapter 6.2 - A				
Measurement uncertainty	See chapter 8				

Limits:

FCC	IC		
Conducted 1.0 W / 30 dBm with	Conducted 1.0 W / 30 dBm with an antenna gain of max. 6 dBi		
Conducted limit with a	Conducted limit with a gain of 9 dBi = 27 dBm		

Results:

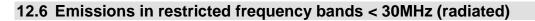
Single-chain operation (max. 9dBi; Limit 27dBm)

antenna port 0	maximum output power / dBm			
	lowest channel	middle channel	highest channel	
Output power conducted DSSS / b – mode	15.1	16.7	12.9	
Output power conducted OFDM / g – mode	22.1	22.7	21.8	
Output power conducted OFDM / n HT20 – mode	22.3	23.0	22.6	
Output power conducted OFDM / n HT40 – mode	18.4	23.1	15.9	

antenna port 1	maximum output power / dBm		
	lowest channel	middle channel	highest channel
Output power conducted DSSS / b – mode	14.7	16.7	12.6
Output power conducted OFDM / g – mode	22.3	23.0	21.8
Output power conducted OFDM / n HT20 – mode	22.3	23.4	22.7
Output power conducted OFDM / n HT40 – mode	17.6	23.0	16.2

Dual-chain operation (max. 6dBi; Limit 30dBm)

antenna port 0 + 1 calculated	maximum output power / dBm			
Calculated	lowest channel	middle channel	highest channel	
Output power conducted DSSS / b – mode	17.9	19.7	15.8	
Output power conducted OFDM / g – mode	25.2	25.9	24.8	
Output power conducted OFDM / n HT20 – mode	25.3	26.2	25.7	
Output power conducted OFDM / n HT40 – mode	21.0	26.1	19.1	



Description:

Measurement of the radiated spurious emissions in transmit mode below 30 MHz. The limits are recalculated to a measurement distance of 3 m with 40 dB/decade according CFR Part 2.

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Measurement:

Measurement parameter			
Detector	Peak / Quasi Peak		
Sweep time	Auto		
Resolution bandwidth	F < 150 kHz: 200 Hz F > 150 kHz: 9 kHz		
Video bandwidth	F < 150 kHz: 1 kHz F > 150 kHz: 100 kHz		
Span	9 kHz to 30 MHz		
Trace mode	Max Hold		
Measured modulation	 ☑ DSSS b – mode □ OFDM g – mode ☑ OFDM n HT20 – mode ☑ OFDM n HT40 – mode 		
Test setup	See chapter 6.1 B		
Measurement uncertainty	See chapter 8		

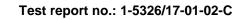
Limits:

FCC			IC
Frequency / MHz	Field Strength	n / (dBµV / m)	Measurement distance / m
0.009 – 0.490 2400/F		⁼ (kHz)	300
0.490 – 1.705	24000/	F(kHz)	30
1.705 – 30.0	3	0	30

Results:

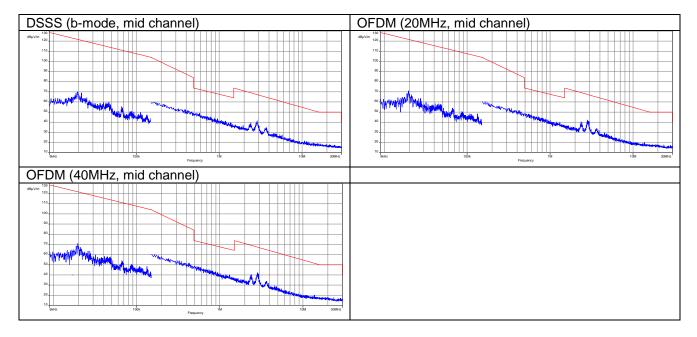
TX spurious emissions radiated < 30 MHz / (dBµV / m) $@$ 3 m				
Frequency / MHz Detector Level / (dBµV / m)				
All detected peaks are more than 20 dB below the limit.				

Note: Peak Emissions detected are more than 20dB below the limit on all tested channels, data rates and antenna configurations. Therefore, only one plot per modulation and antenna configuration is reported.

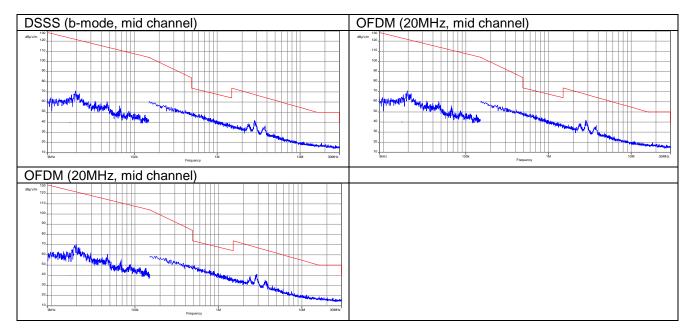


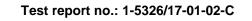
CTC I advanced

Plots: ANT-DIR-2459-01, single-chain, antenna 0



Plots: ANT-DIR-2459-01, single-chain, antenna 1

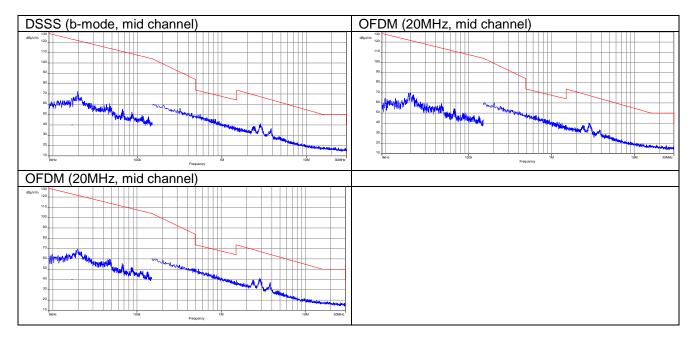






Plots: RAD-ISM-2400-ANT-OMNI-6-0, dual-chain, antenna 0&1

Plots: RAD-ISM-2400-ANT-VAN-3-0-RSMA, dual-chain, antenna 0&1





12.7 Emissions in restricted frequency bands > 30 MHz (conducted)

Description:

The DTS rules specify that emissions which fall into restricted frequency bands shall comply with the general radiated emission limits.

Measurement:

Measurement parameter				
According to DTS clause 12.2.2				
Detector	Peak / RMS			
Sweep time	Auto			
Resolution bandwidth	30 MHz > F > 1 GHz: 1 GHz > F > 26 GHz:	100 kHz 1 MHz		
Video bandwidth	3x RBW			
Span	30 MHz to 26 GHz			
Trace mode	Max Hold / Trace Average			
Measured modulation	 ☑ DSSS b – mode □ OFDM g – mode ☑ OFDM n HT20 – mode ☑ OFDM n HT40 – mode □ RX / Idle – mode 			
Test setup	See chapter 6.2 – B (f < 1 GHz) See chapter 6.2 – B (f > 1 GHz)			
Measurement uncertainty	See chapter 8			



Limits:

FCC	IC
Attenuation below the general limits specified in Se emissions which fall in the restricted bands, as defin emission limits specified in §15.209(a) (see §15.205(c)	ed in §15.205(a), must also comply with the radiated

As per DTS KDB clause 12.2.2 (e) the field strength limit as specified in §15.209(a) is converted to an EIRP limit by the formula

EIRP = E + 20log D - 104.8

where:

E = electric field strength in $dB\mu V/m$,

EIRP = equivalent isotropic radiated power in dBm

D = specified measurement distance in meters.

Frequency / MHz	Field Strength Limit / (dBµV / m)	Distance / m	Ground Reflection Factor / dB	EIRP Limit / dBm
30 - 88	40.0	3	4.7	-60.0
88 - 216	43.5	3	4.7	-56.4
216 - 960	46.0	3	4.7	-53.9
960 - 1000	53.9	3	4.7	-46.0
Above 1000	53.9	3	0	-41.3

Note: The EIRP Limit is further reduced to account for the Ground Reflection Factor. Antenna gain as well as antenna multiplication factor* (if applicable) is considered in the Ref.Level Offset.

*Antenna multiplication factor = 10 log (n)

where:

n = number of antenna chains

The EIRP Limit is reduced further to account for the Ground Reflection Factor.

A **9dB** Offset is used to account for the maximum gain of the directional antenna (ANT-DIR-2459-01) in singlechain mode.

The **9dB** Offset is also used to account for the 6dBi antenna (RAD-ISM-2400-ANT-OMNI-6-0) in dual-chain mode (6dBi + 10 log (2) = 9dB).

For measurements performed with an Average Detector (>1GHz) an additional Offset of 0.23 dB is used to account for the Duty Cycle correction. A factor of 0.23 was used to represent the worst case or lowest duty cycle respectively.

Note:

The result tables below contain the worst case emissions per sub-range or frequencies exceeding the applicable limit. Additional frequencies can be found in the result tables below the plots.

With regards to the emission at **2288 MHz** which is exceeding the applicable limit, the restricted band measurement was repeated on this frequency in a radiated way using a representative set of antennas as declared in section 10. The results of these measurements can be found in section 12.8.

		т	X spurious	emissions ra	adiated / dB	m		
	lowest chann	el	m	niddle channe	el	ł	nighest chann	nel
f / MHz	Detector	Level / dBm	f / MHz	Detector	f / MHz	Detector	Level / dBm	
4824.0	AVG	-43.0	4874.0	AVG	-45.3	4924.0	AVG	-49.6
7234.8	AVG	-53.9	7311.8	AVG	-51.5	-/-	-/-	-/-

<u>Results:</u> DSSS (single-chain, antenna 1)

Results: OFDM – 20 MHz (single-chain, antenna 1)

	TX spurious emissions radiated / dBm													
f / MHz	Detector	Level / dBm	f / MHz	Detector	Level / dBm	f / MHz	Detector	Level / dBm						
2390.0	AVG	-45.4	2483.5	AVG	-43.8	2115.0	AVG	-50.7						
2483.5	AVG	-45.4	7312.8	AVG	-55.6	2483.5	AVG	-43.7						
4825.8	AVG	-53.7	-/-	-/-	-/-	-/-	-/-	-/-						



	TX spurious emissions radiated / dBm												
Iowest channel middle channel highest channel Level / Level / Level / Level /													
f / MHz	Detector	Level / dBm	f / MHz	Detector	Level / dBm	f / MHz	Detector	Level / dBm					
2288.0	AVG	-46.8	2288.0	AVG	-47.0	2288.0	AVG	-47.4					
2390.0	AVG	-41.6	2390.0	AVG	-43.1	2483.5	AVG	-45.0					
2483.5	AVG	-45.2	2483.5	AVG	-42.4	-/-	-/-	-/-					

<u>**Results:**</u> OFDM – 40 MHz (single-chain, antenna 1)

Results: DSSS (single-chain, antenna port 1)

		т	X spurious	emissions ra	adiated / dB	m		
	lowest chann	el	r	niddle channe	el	ł	nighest chanr	nel
f / MHz	Detector	Level / dBm	f / MHz	Detector	Level / dBm	f / MHz	Detector	Level / dBm
172.6	Peak	-69.3	2288.0	AVG	-42.1	2288.0	AVG	-41.3
2288.0	AVG	-42.3	2319.9	AVG	-43.7	2319.9	AVG	-43.9
2319.9	AVG	-43.3	2390.0	AVG	-44.7	2390.0	AVG	-46.3
2390.0	AVG	-45.9	2483.5	AVG	-45.5	2483.5	AVG	-45.8
2483.5	AVG	-46.2	4874.5	AVG	-46.6	4924.5	AVG	-50.1
4824.8	AVG	-44.2	-/-	-/-	-/-	-/-	-/-	-/-

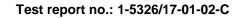


		т	X spurious	emissions ra	adiated / dB	m		
	lowest chann	el	r	niddle channe	el	h	nighest chanr	nel
f / MHz	Detector	Level / dBm	f / MHz	Detector	Level / dBm	f / MHz	Detector	Level / dBm
170.2	Peak	-69.5	170.2	Peak	-71.3	2288.0	AVG	-46.4
2288.0	AVG	-46.6	2319.9	AVG	-43.3	2319.9	AVG	-43.6
2319.9	AVG	-43.8	2390.0	AVG	-44.7	2390.0	AVG	-45.8
2390.0	AVG	-45.6	2483.5	AVG	-44.3	2483.5	AVG	-45.2
2483.5	AVG	-45.9	-/-	-/-	-/-	-/-	-/-	-/-

Results: OFDM - 20 MHz (single-chain, antenna port 1)

Results: OFDM – 40 MHz (single-chain, antenna port 1)

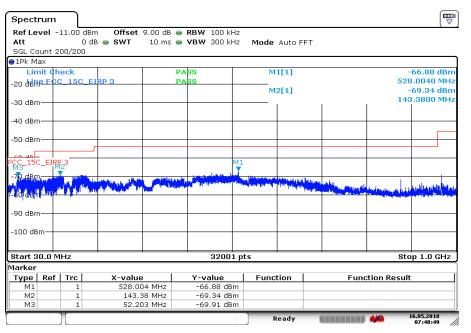
		т	X spurious (emissions ra	adiated / dB	m				
	lowest chann	el	r	niddle channe	el	ł	nighest chanr	nel		
f / MHz	Detector	Level / dBm	f / MHz	Detector	Level / dBm	f / MHz Detector Level / dBm				
2288.0	AVG	-44.7	2288.3	AVG	-45.7	170.2	Peak	-69.2		
2319.9	AVG	-44.1	2320.1	AVG	-43.5	2288.0	AVG	-44.5		
2390.0	AVG	-43.3	2390.0	AVG	-43.7	2319.9	AVG	-44.2		
2483.5	AVG	-47.9	2483.5	AVG	-44.2	2390.0	AVG	-49.7		
-/-	-/-	-/-	-/-	-/-	-/-	2483.5	AVG	-44.9		





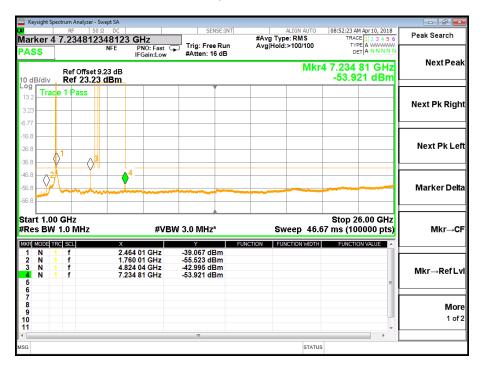
Plots: DSSS / b - mode

Plot 1: Lowest channel / 30MHz to 1GHz / Antenna port 0



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Plot 2: Lowest channel / 1GHz to 26GHz / Antenna port 0

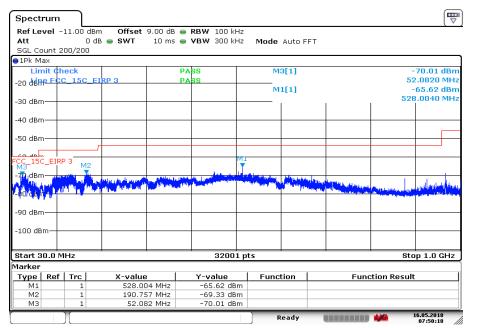




									n Analyzer -		eysigh	
Marker	Apr10, 2018 E 1 2 3 4 5 6	TRAC		#Avg Typ	E:INT	1		50 Ω DC	RF 5	F	_	X/
Select Marker 5		TYF DE	:>100/100	AvgiHold	Run dB	Trig: Free #Atten: 16	PNO: Fast C IFGain:Low	NFE t 9.23 dB				PAS
					*	ľ		23 dBm		iv R e race 1	1.1	10 d Log 13.2
Norm												3.23
												6.77 16.8
Del				.2								26.8 36.8
				P	L	Ŷ						46.8
Fixed											1	56.8 66.8
c	:000 GHz 0000 pts) NVALUE	67 ms (10	/eep 6.66		EUN	3.0 MHz*	#VB	×	MHz	2.0000 3W 1.0 E TRC 50	es B	#Re
Properties		roneric			m	-46.745 dB -44.924 dB	00 000 GHz 33 500 GHz	2.39	F	1 f 1 f	N N	1 2 3
Fropenaes	=											4 5 6
Moi 1 of	E											

Plot 3: Lowest channel / 2 GHz to 2.8GHz / Antenna port 0 (Band Edge)

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Plot 4: Middle channel / 30MHz to 1GHz / Antenna port 0

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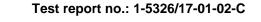
Plot 5: Middle channel / 1GHz to 26GHz / Antenna port 0

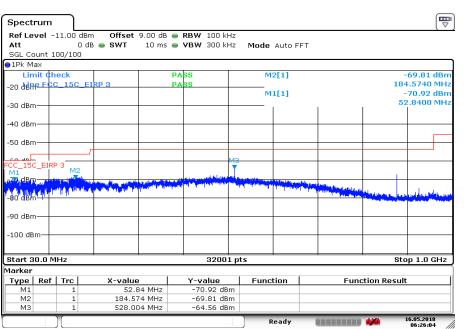
	pectrum Analyzer - S						
	RF 50			SENSE:INT	ALIGN AUTO #Avg Type: RMS	08:50:18 AM Apr 10, 2018 TRACE 1 2 3 4 5 6	Peak Search
Ass	3 7.311813	118131 NFE	GHZ PNO: Fast (IFGain:Low	➡ Trig: Free Run #Atten: 16 dB	Avg Hold:>100/100	TYPE A WWWWW DET A NNNN	
I0 dB/div	Ref Offset 9 Ref 23.23				Mkr	3 7.311 81 GHz -51.552 dBm	Next Pea
3.23	ce 1 Pass						Next Pk Rig
-6.77 -16.8 26.8 36.8							Next Pk Lo
46.8 56.8	1 on	,	3				Marker De
tart 1.0 Res BW	/ 1.0 MHz	×	#VB	W 3.0 MHz*	Sweep 46.6	Stop 26.00 GHz 57 ms (100000 pts) cunction value	Mkr→
1 N 2 N 3 N 4 5 6	1 f 1 f 1 f	4.8 1.7	74 04 GHz 60 01 GHz 11 81 GHz	-45.345 dBm -55.994 dBm -51.552 dBm	PONCTION WIDTH	FUNCTION VALUE	Mkr→Ref
6 7 8 9 10 11							M c 1 c
						•	
sg					STATUS		



												Analyzer -		ysight	🖌 Kej
Marker	AM Apr 10, 2018 ACE 1 2 3 4 5 6	TRA		Avg Typ			SENSE				Ω DC	F 50	R		u
Select Marker 5		D	>100/100	vg Hold				Trig: Fr #Atten:	Fast ⊊ n:Low			of Offset		SS B/div	PAS
Norm						Λ							ace 1	_	-og 13.2 3.23 -6.77
Del							<u>1</u>								-16.8 -26.8 -36.8
Fixed															-46.8 -56.8 -66.8
C	.8000 GHz 00000 pts) 100 VALUE	67 ms (10	eep 6.60		FUNCTION		z*	3.0 MH	#VBW		×	MHz	0000 (N/ 1.0	s Bl	₹Re
Properties	E	Toneti			oner	1		46.559 (44.699 (90 000 33 500	2.39		1 f 1 f	N N	1 2 3 4 5
Mo 1 of															6 7 8 9 10 11
	•				_	_	_	m		_				_	•

Plot 6: Middle channel / 2 GHz to 2.8GHz / Antenna port 0 (Band Edge)





Plot 7: Highest channel / 30MHz to 1GHz / Antenna port 0

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Plot 8: Highest channel / 1GHz to 26GHz / Antenna port



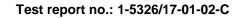
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member of RWTÜV group



			_				m Analyzer - S	ht Spectri	Keysi
Marker	08:54:09 AM Apr 10, 2018 TRACE 1 2 3 4 5 6	ALIGN AUTO ype: RMS	#A	SENSE:IN		0Ω DC	RF 50		
Select Marke	TYPE A WWWWW DET A NNNNN	id:>100/100	ı Av	Trig: Free Run #Atten: 16 dB	PNO: Fast C IFGain:Low	NFE	ef Offset 9		ASS
							lef 23.23		0 dB
				Y I			Pass	Frace 1	13.2 -
Norm									3.23 -
									6.77
									16.8
De									26.8
			2						36.8
									46.8
Fixe					and the second sec				56.8 🖌
									56.8
	Stop 2.8000 GHz						GH7	2.0000	⊥ tart
c	67 ms (100000 pts)	Sweep 6.66		V 3.0 MHz*	#VB			BW 1.	
	FUNCTION VALUE	UNCTION WIDTH	FUNCTION	Y		X		DE TRC	
	I			-48.294 dBm -45.321 dBm	0 000 GHz 3 500 GHz		f f		1 1
Propertie									3 4
	E								5
	T								7
Mo									8 9
1 0									10 11
	,			m			1	1 1	
		STATUS							6G

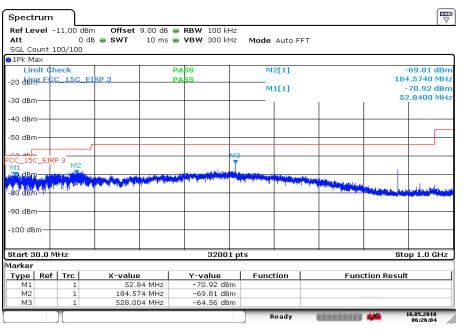
Plot 9: Highest channel / 2 GHz to 2.8GHz / Antenna port 0 (Band Edge)





Plots: OFDM - 20 MHz

Plot 1: Lowest channel / 30MHz to 1GHz / Antenna port 0



Date:16MAY.2018 06:26:05

Plot 2: Lowest channel / 1GHz to 26GHz / Antenna port 0



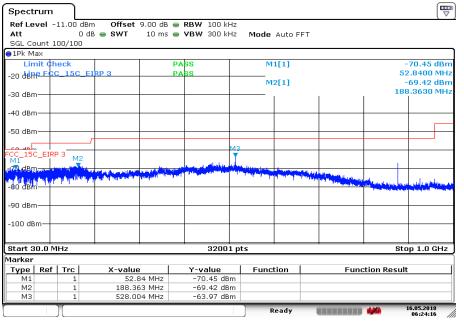


										Analyzer -		ysight	- Ke
Marker	M Apr 10, 2018 E 1 2 3 4 5 6	TRAC	ALIGN AUTO e: RMS	#Avg Typ		NSE:	1		0Ω DC	F 50	R		u –
Select Marke		DE	>100/100	Avg Hold	in 3	e Ru 6 dE	Trig: Free #Atten: 1	PNO: Fast ⊂ IFGain:Low	NFE 9.23 dB			S	PAS
						Y			3 dBm	ef 23.23		B/div	10 d Log
Norm										ass	ace 1		13.2
Norm						m						⊢	3.23
												⊢	6.77
												⊢	16.8
Del						Ľ						⊢	26.8
				2		h							36.8
				2	-	/	y						46.8
Fixed						_				-		ļ	56.8
													-66.8
c	8000 GHz 0000 pts)		eep 6.66	Sv		*	3.0 MHz	#VBI			0000 (W 1.0		
	DN VALUE	FUNCTION	CTION WIDTH	TION FU	FUN		Y		X	L	TRC SC		_
							-45.421 di -45.412 di	0 000 GHz 3 500 GHz			1 f 1 f	N N	1
Properties													3 4
	E												5
													6 7
Mo													8 9
1 0													10 11
	•						m						(
			STATUS										

Plot 3: Lowest channel / 2 GHz to 2.8GHz / Antenna port 0 (Band Edge)

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Test report no.: 1-5326/17-01-02-C



Plot 4: Middle channel / 30MHz to 1GHz / Antenna port 0

Date:16MAY.2018 06:24:16

Plot 5: Middle channel / 1GHz to 26GHz / Antenna port 0

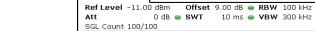
										n Analyzei		ysight	
Marker	4 Apr 10, 2018 E 1 2 3 4 5 6	TRAC		#Avg Typ	NSE:INT			DC	50 Ω	RF	F		
Select Mark		DE	:>100/100	Avg Hold		Trig: Fre #Atten: 1	NO: Fast 🕞 Gain:Low	IF		ef Offse	Re	S	٩S
								3m	23 d	ef 23.	-	B/div	de g
Nor										Pass	ice 1		3.2 .23
													77 - 5.8 -
D													6.8 6.8
Fixe								1			$\mathbf{\Lambda}$		5.8 5.8
FIX									~~~		~		5.8 5.8
	6.00 GHz 0000 pts)	67 ms (10	-			V 3.0 MHz	#VBV			MHz		s Bl	les
	DN VALUE	FUNCTIO	ICTION WIDTH	ICTION FUN		-55.602 d	1 GHz	× 7.308 3			TRC SC 1 f	N	
Properti	E												3 4 5
M 1													, , , , ,
						m							i





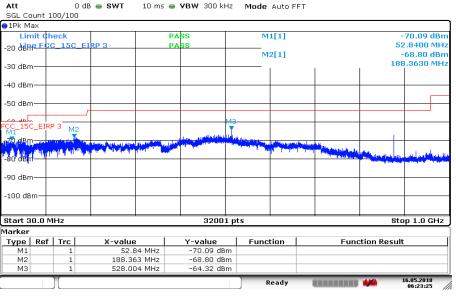
									Analyzer -		eysight	u Ke
Marker	09:09:18 AM Apr 10, 2018 TRACE 1 2 3 4 5 6		#Avg Ty		ENSE:			0Ω DC	(F 5	F		×I
Select Marke	TYPE A WWWW DET A NNNNN	>100/100	Avg Hold			Trig: Fre #Atten:	PNO: Fast G	NFE 9.23 dB 3 dBm			SS	PA:
Norm				M						ace 1		13.2 3.23
Del			2	Д								-16.8 -26.8 -36.8
Fixed											•	46.8 56.8 66.8
с	Stop 2.8000 GHz ms (100000 pts)	eep 6.66		I EU	Z*	/ 3.0 MH:	#VBV	X	MHz	0000 W 1.0	es B	#Re
Properties	E			1		-46.404 d -43.756 d	000 GHz 500 GHz	2.39		1 f 1 f	N N	1 2 3 4 5
Mo 1 of												6 7 9 10
	•	STATUS			_	III						

Plot 6: Middle channel / 2 GHz to 2.8GHz / Antenna port 0 (Band Edge)



Test report no.: 1-5326/17-01-02-C

Plot 7: Highest channel / 30MHz to 1GHz / Antenna port 0



Date:16MAY.2018 06:23:26

Plot 8: Highest channel / 1GHz to 26GHz / Antenna port 0



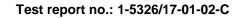
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										Analyzer - S		ght Spe	Keysi
Marker	Apr 10, 2018 E 1 2 3 4 5 6	TRAC		#Avg Typ		ENSE:I			ΩDC	50 9	RF	_	
Select Marker 5		TYF DE	>100/100	Avg Hold			Trig: Fr #Atten:	PNO: Fast G		Offset 9 7 23.23			ASS dB/
Norm					M	Y					e 1 P		
Delt				⟩ <mark>2</mark>		<u>1</u>							6.8 - 6.8 - 6.8 -
Fixed													6.8 - 6.8 - 6.8 -
c	000 GHz 0000 pts)	67 ms (10	eep 6.66		FUNC	z*	3.0 MH	#VBW	×	MHz	00 G 1.0 F	BW	Res
Properties	E						-46.239 c -43.665 c	00 GHz 00 GHz	2.390		f	1	1 N 2 N 3 4 5
Mo 1 of													7 B 9 D 1

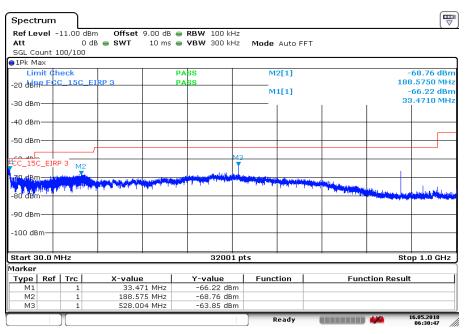
Plot 9: Highest channel / 2 GHz to 2.8GHz / Antenna port 0 (Band Edge)





Plots: OFDM / n40 - mode

Plot 1: Lowest channel / 30MHz to 1GHz / Antenna port 0



Date:16MAY.2018 06:30:47

Plot 2: Lowest channel / 2 GHz to 2.8GHz / Antenna port 0 (Band Edge)

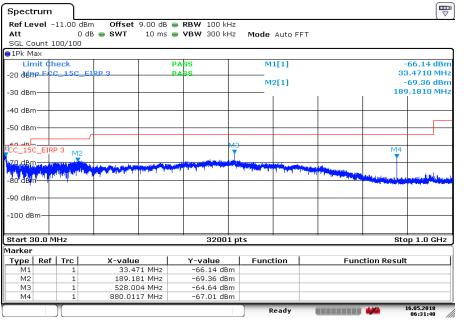




SENSE:INT ALIGN AUTO	09:16:45 AM Apr10, 2018
GHz #Avg Type: RMS	TRACE 1 2 3 4 5 6 Peak Search
PNO: Fast Trig: Free Run Avg Hold:>100/100 IFGain:Low #Atten: 16 dB	
Mkr	3 2.287 963 GHz -46.840 dBm
	Next Pk Rig
	Next Pk Le
	Marker De
	Stop 2.8000 GHz
#VBW 3.0 MHz* Sweep 6.0	667 ms (100000 pts) Mkr→(
Y FUNCTION FUNCTION WIDT	H FUNCTION VALUE
000 GHz -41.644 dBm 500 GHz -45.181 dBm	
963 GHz -46.846 dBm	Mkr→RefL
	Mo
	10
m	•
STAT	US

Plot 3: Lowest channel / 2 GHz to 2.8GHz / Antenna port 0 (Band Edge)

Test report no.: 1-5326/17-01-02-C



Plot 4: Middle channel / 30MHz to 1GHz / Antenna port 0

Date:16MAY.2018 06:31:48

Keysight Spectrum Analyzer - Swept SA RF 50 Ω DC 09:21:46 AM Apr 10, 2018 TRACE 1 2 3 4 5 6 TYPE A WWWW DET A N N N N #Avg Type: RMS Avg|Hold:>100/100 Marker Trig: Free Run #Atten: 16 dB NFE PNO: Fast IFGain:Low PASS Select Marker Ref Offset 9.23 dB Ref 23.23 dBm 10 dB/div Trace 1 Pass Norma Delta 26.1 36. 46.8 **Fixed**▷ Stop 26.00 GHz Sweep 46.67 ms (100000 pts) Start 1.00 GHz #Res BW 1.0 MHz #VBW 3.0 MHz* Off MKR MODE TRC SCL FUNCTION FUNCTION WIDTH FUNCTION VALUE 2 3 4 5 6 7 8 9 10 11 Properties) More 1 of 2 STATUS

Plot 5: Middle channel / 1GHz to 26GHz / Antenna port 0

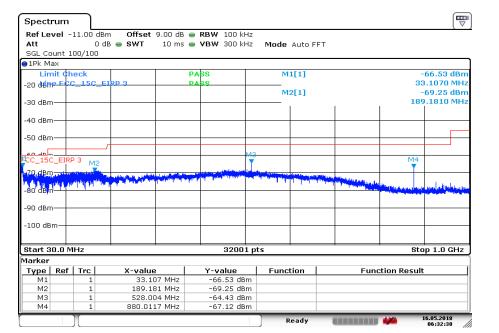




Keysight Spectrum An					- 7 2
RF	50 Ω DC	SENSE:INT	ALIGN AUTO #Avg Type: RMS	09:19:50 AM Apr 10, 2018 TRACE 1 2 3 4 5 6	Marker
	NFE PNO: Fast IFGain:Low		Avg[Hold:>100/100	TYPE A WWWWW DET A NNNNN	Select Marker 5
0 dB/div Ref : 0 g 13.2 Trace 1 Pa 3.23	23.23 dBm ss				Norm
5.77 16.8 26.8					Del
36.8 46.8 56.8	J	,3			Fixed
56.8 Start 2.0000 GH Res BW 1.0 M	Hz #V	BW 3.0 MHz*	-	Stop 2.8000 GHz 67 ms (100000 pts)	c
IKR MODE TRC SCL 1 N 1 f 2 N 1 f 3 N 1 f 4 - - -	X 2.390 000 GHz 2.483 500 GHz 2.287 963 GHz	-43.082 dBm -42.440 dBm -46.971 dBm	FUNCTION FUNCTION WIDTH	FUNCTION VALUE	Propertie
6 7 8 9 10					Mo 1 o
		m			

Plot 6: Middle channel / 2 GHz to 2.8GHz / Antenna port 0 (Band Edge)

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Plot 7: Highest channel / 30MHz to 1GHz / Antenna port 0

Date:16MAY.2018 06:32:38



Plot 8: Highest channel / 1GHz to 26GHz / Antenna port





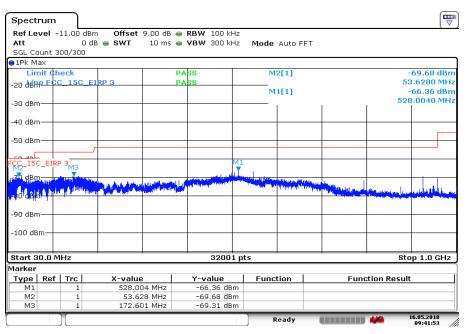
	09:22:59 AM Apr 10, 2018	ALIGN AUTO	IT .	SENSE:IN		50 Ω DC	RF		**
Peak Search	TRACE 1 2 3 4 5 6	Type: RMS	#Av			54879549		ker 3	Mar
NextPe	TYPE A WWWW DET A N N N N N	old:>100/100	n Avg	Trig: Free Run #Atten: 16 dB	PNO: Fast C IFGain:Low	NFE		S	PAS
NextPe	2.287 955 GHz -47.395 dBm	Mkr3				et 9.23 dB . 23 dBm		B/div	10 d
				T T			e 1 Pass		og
Next Pk Rig									13.2
									3.23
									6.77
No. of Dist									16.8
Next Pk L								<u> </u>	-26.8
			2		3				-36.8
	Г				<u> </u>			<u> </u>	-46.8
Marker De					- International Association		- land	-	-56.8
								<u> </u>	-66.8
	Stop 2.8000 GHz						00 GHz	± 2.00	5 4
Mkr→	57 ms (100000 pts)	Sweep 6.66		V 3.0 MHz*	#VB		1.0 MHz		
	FUNCTION VALUE	FUNCTION WIDTH	FUNCTION	¥ I		X	act set	MODE TR	MKB
	FORCHOR VALUE	ronenon morri	ronemon	-51.337 dBm	0 000 GHz	2.39	f	N 1	1
							f	N 1	2
Mkr. Dofi				-45.011 dBm -47.419 dBm	3 500 GHz 7 955 GHz		f	N 1	3
Mkr→RefL								N 1	4
Mkr→RefL	E							N 1	4 5 6
	=							N 1	4 5
Ma	= _							N 1	4 5 6 7 8 9
	=							N 1	4 5 6 7 8

Plot 9: Highest channel / 2 GHz to 2.8GHz / Antenna port 0 (Band Edge)



Plots: DSSS / b - mode

Plot 1: Lowest channel / 30MHz to 1GHz / Antenna port 1



Date:16MAY.2018 09:41:53

Plot 2: Lowest channel / 1GHz to 26GHz / Antenna port 1

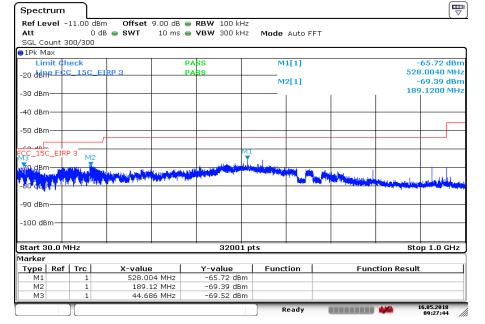
								nalyzer - Swej		eysight S
Peak Search	M Apr 09, 2018 CE 1 2 3 4 5 6 PE A WWWWW	TRA	ALIGN AUTO /pe: RMS Id:>100/100		SENSE:INT	IZ NO: Fast ♀	DC 7632 G	076320	RF 2 2.32	
NextPe	ETANNNN				#Atten: 16 dB	Gain:Low	IFC P			SS
Hextr e	76 GHz 46 dBm		Mkr					Dffset 9.2 23.23 d		B/div
								ISS	ce 1 P	1.1.1.1
Next Pk Rig										2
	[-
Next Pk L										
Marker De										
							4		\Diamond	
Mkr→		-					, Yes	www		
WIKI→										
Mkr→Ref	6.00 GHz		weep 46.6		3.0 MHz*	#VBW		IH7	0 GHz V 1.0 N	
	ON VALUE	· ·	UNCTION WIDTH	FUNCTION	Y		х		TRC SCL	MODE
	E				-50.825 dBm -43.146 dBm		2.640 7 2.320 7		1 f 1 f	NN
Mo					44.221 dBm 55.537 dBm	9 GHz	4.824 7		1 f	NN
1 0							1.201 0			
	- F				III					



XI I		um Analyzer - S RF 50 .483500	Ω DC 000000 GHz			ISE:INT	#Avg Typ		TRAC	1 Apr 09, 2018 E 1 2 3 4 5 6	Recall State
PAS		Ref Offset 9 Ref 23.23	IFGain: 9.23 dB	Fast 😱 ELow	Trig: Free #Atten: 16		Avg Hold	i:>100/100 Mkr3	DE 2.319 8	99 GHz 0 dBm	From File
13.2 3.23	Trace					A					Edit Registe Names
-6.77 -16.8											Registe Last: 4/9/20 2:16:20 F
26.8 36.8 46.8				Q ⁴ •			Q ²	¢ ⁵			Registe Last: 4/4/20 1:22:33
56.8 66.8										••••••	Registe Last: 4/4/20 1:23:10
KR 1	t 2.000 5 BW 1. 1005 mrc	.0 MHz	х	#VBW 3	Y	FUN		veep 6.60	67 ms (10	000 GHz 0000 pts)	Registe Last: 4/9/20 2:16:51
1 2 3 4 5 6	N 1 N 1 N 1 N 1 N 1	f f f f	2.390 000 GH 2.483 500 GH 2.319 899 GH 2.287 923 GH 2.559 926 GH	lz - lz - lz -	45.853 dE 46.231 dE 43.274 dE 42.349 dE 45.373 dE	Bm Bm Bm				E	M α 1 c
sg 🥥	Recalle	ed State Re	gister 4		ш			STATUS	5	•	

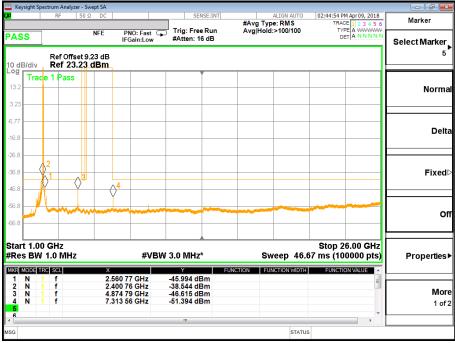
Plot 3: Lowest channel / 2 GHz to 2.8GHz / Antenna port 1 (Band Edge)

Plot 4: Middle channel / 30MHz to 1GHz / Antenna port 1



Date:16MAY.2018 09:27:44

Plot 5: Middle channel / 1GHz to 26GHz / Antenna port 1

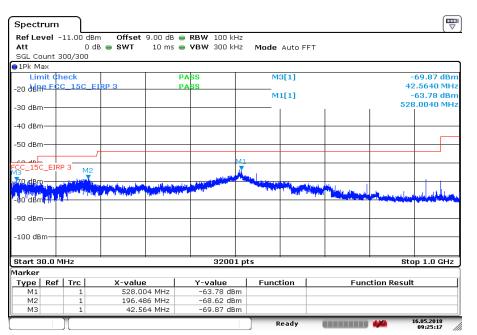


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Key	sight Spectru	m Analyzer - S RF 50				ENSE:INT		ALIGN AUTO	02:43:31 PM	A00 2010	- ¢
/ /larl	(er 2 2.		000000 G		Trig: Fre			Type: RMS old:>100/100	TRACE	1 2 3 4 5 6 A WWWWW	Recall State
PAS	R	tef Offset 9	IF 9.23 dB	PNO: Fast ⊂ Gain:Low	#Atten:		Avgino		DET	9 GHz	From File
10 dE		tef 23.23	dBm				_		-43.73	3 dBm	
13.2	Trace 1	Pass									Edit Registe Name
3.23						$+ \mathbb{A}$	_				Hame
6.77 16.8											Registe Last: 4/9/20
											2:16:20
26.8 36.8					3		A2	٨5			Registe Last: 4/4/20
46.8				ľ	Land Street		Y	V			1:22:33
56.8											Registe Last: 4/4/20
66.8											1:23:10
Res	t 2.0000 s BW 1.0	0 MHz		#VBI	W 3.0 MHz			Sweep 6.6		000 pts)	Registe Last: 4/9/20 2:16:51
		f	× 2.390 00	0 GHz	¥ -44.731 d		NCTION	FUNCTION WIDTH	FUNCTION		
2 3 4	N 1 N 1 N 1	f f f f	2.483 50 2.319 89 2.287 92 2.559 92	00 GHz 99 GHz 23 GHz	-45.488 d -43.707 d -42.133 d -45.788 d	IBm IBm IBm				=	M e 1 c
< Ê					m					- +	
sg 🧯	Recalled	d State Re	gister 4					STATUS	3		

Plot 6: Middle channel / 2 GHz to 2.8GHz / Antenna port 1 (Band Edge)



Plot 7: Highest channel / 30MHz to 1GHz / Antenna port 1

Test report no.: 1-5326/17-01-02-C

Date:16MAY.2018 09:25:17

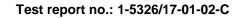
Plot 8: Highest channel / 1GHz to 26GHz / Antenna port

								trum Analyzer - Sv	
Peak Search	3 PM Apr 09, 2018 RACE 1 2 3 4 5 6 TYPE A WWWW DET A N N N N N	TR	ALIGN AUTO De: RMS I:>100/100		SENSE:INT	GHz PNO: Fast		RF 50 S 2.4005140	
NextPe	0 51 GHz 897 dBm	2 2.400	Mkr		#Atten: 16 dB	IFGain:Low	.23 dB	Ref Offset 9	ASS
	.897 dBm	-38.6					dBm	Ref 23.23) dB/div og 🕞
Next Pk Rig								e 1 Pass	3.2
									.23
	F								77
Next Pk L									5.8
									5.8
Marker Do								2	5.8
									5.8
								Ľ.	5.8 1
Mkr→								~~~~~	5.8
Mkr→Ref	26.00 GHz 100000 pts)		veep 46.6		3.0 MHz*	#VB		GHz 1.0 MHz	art 1.00 Res BW
	CTION VALUE	FUNC	NCTION WIDTH	FUNCTION	Y		х		R MODE T
M	B				-45.478 dBm -38.897 dBm	77 GHz 51 GHz	2.400	f	1 N 2 N
1					-50.095 dBm	54 GHz	4.924	f	3 N 4 5
	•				m				Ř.
			STATUS						3



Key	sight Spectr	rum Analyzer -								- 6
XI		RF 5	0Ω DC		SENSE:1	#A	ALIGN AUTO	TRACE 1 2	3456	Recall State
FAIL		Ref Offset Ref 23.2	9.23 dB	PNO: Fast C FGain:Low	Trig: Free Ru #Atten: 16 dE		gjHold:>100/100 Mkr	TYPE A ¥ DET A № 3 2.319 899 -43.879 (GHz	From File
13.2 3.23	Trace					Λ				Edit Registe Names
-6.77 -16.8										Register Last: 4/9/20 2:16:20 F
-26.8 -36.8 -46.8				4	3	- Q2	⁵			Registe Last: 4/4/20 1:22:33
56.8 66.8	and and some									Registe Last: 4/4/20 1:23:10
#Res	IODE TRC	.0 MHz	×		W 3.0 MHz*	FUNCTION	Sweep 6.	Stop 2.8000 667 ms (10000	0 pts)	Registe Last: 4/9/20 2:16:51
2 3 4	N 1 N 1 N 1 N 1 N 1	f f f f	2.390 0 2.483 5 2.319 8 2.287 9 2.559 9	00 GHz 99 GHz 23 GHz	-46.345 dBm -45.836 dBm -43.879 dBm -41.371 dBm -45.228 dBm				E	M c 1 c
ci sg 🖬	Recalle	ed State R	egister 4		III		STAT	us	Þ	

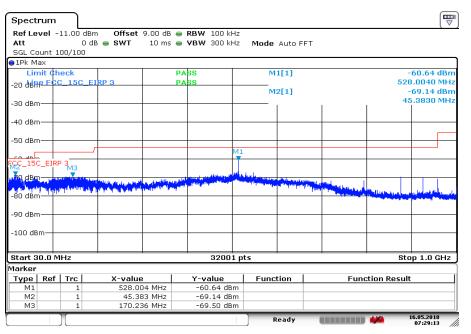
Plot 9: Highest channel / 2 GHz to 2.8GHz / Antenna port 1 (Band Edge)





Plots: OFDM - 20 MHz

Plot 1: Lowest channel / 30MHz to 1GHz / Antenna port 1



Date:16MAY.2018 07:29:13

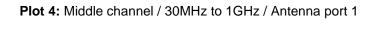
Plot 2: Lowest channel / 1GHz to 26GHz / Antenna port 1

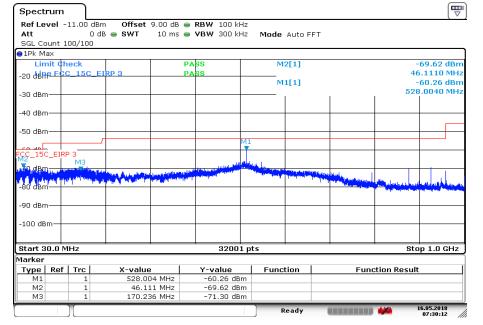
er 3 4.824288242882 GHz Trig: Free Run #GainLow #Avg Type: RMS Avg Hold:>100/100 Trace 1 2.3.4.5 6 Trice 1 2.3.5 7 Trice 1								m Analyzer - Sw	ight Spectru				
NFE PRO: Fast Trig: Free Run #Atten: 16 dB Avg Hold:>100/100 Trig: Free Run Der[A WWWWW Ber[A WWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWW	Peak Search	02:33:52 PM Apr 09, 2018 TRACE 1 2 3 4 5 6		#		GH7			er 3 4	<mark>X</mark> Mark			
Ref Offset 9.23 dB -54.986 dBm Irrace 1 Pass -54.986 dBm Next Pk Right Next Pk Left Marker Delta	NovtBoa	DETANNNN				PNO: Fast	NFE	0212002		PAS			
$Mext Pk Right Next Pk Right Next Pk Right Next Pk Left Marker Delta Mkr \rightarrow CF$	NEXTER		Mkr				3/div Ref 23.23 dBm						
Marker Detta	Next Pk Righ							Pass	Trace 1	13.2 3.23			
	Next Pk Lei									-6.77 -16.8			
	Marker Delt								2 ¹	-26.8 -36.8			
1 00 GHz Stop 26 00 GHz	Mkr→C					-	Mundan	******	Λ	-46.8 -56.8 -66.8			
BW 1.0 MHz #VBW 3.0 MHz* Sweep 46.67 ms (100000 pts) Mkr→RefLv	Mkr→RefLv		-	FUNCTIO	3.0 MHz*	#VBW	X	MHz	BW 1.	#Res			
1 f 2.480 51 GHz -40.652 dBm 1 f 2.320 76 GHz -43.702 dBm			FONCTION WIDTH	FUNCTIO	-43.702 dBm	0 76 GHz	2.480 2.320	f f		1 2 3 4 5			
TT STATUS		•	STATUS		m					≺ C			



XI I	ker 2 2	trum Analyzer - S RF 50 2.4835000	Ω DC 000000 GHz NFE PNO: Fast	SENSE:	#Avg un Avg H	ALIGN AUTO Type: RMS Iold:>100/100	02:32:27 PM Apr 09, 2018 TRACE 1 2 3 4 5 6 TYPE A WWWW DETLA NN NN N	Recall State
10 dE		Ref Offset 9 Ref 23.23		W #Atten: 16 dl	3	Mkr3	2.319 899 GHz -43.766 dBm	From File
og 13.2 3.23	Trace	1 Pass		Y				Edit Registe Name
6.77								Registe Last: 4/9/20 2:16:20 F
26.8 36.8 46.8				×4 ×3 ×1	2	5		Registe Last: 4/4/20 1:22:33
56.8 66.8	I							Registe Last: 4/4/20 1:23:10
Re	t 2.000 5 BW 1 1005 mrc	.0 MHz	#V	'BW 3.0 MHz*	FUNCTION	Sweep 6.6	Stop 2.8000 GHz 67 ms (100000 pts) FUNCTION VALUE	Registe Last: 4/9/20 2:16:51
1 2 3 4 5	N 1 N 1 N 1 N 1 N 1	f f f f	2.390 000 GHz 2.483 500 GHz 2.319 899 GHz 2.287 923 GHz 2.559 926 GHz	-45.550 dBm -45.930 dBm -43.773 dBm -46.626 dBm -45.567 dBm				M c 1 c
	Recall	ed State Re	aister 4	III		STATU	•	

Plot 3: Lowest channel / 2 GHz to 2.8GHz / Antenna port 1 (Band Edge)





Date:16MAY.2018 07:30:12

Plot 5: Middle channel / 1GHz to 26GHz / Antenna port 1

Keysight Sp	pectrum Analyzer - Swe					
« Narker 1	RF 50 Ω		SENSE:INT	ALIGN AUTO #Avg Type: RMS	02:36:09 PM Apr 09, 2018 TRACE 1 2 3 4 5 6	Peak Search
PASS		NFE PNO: Fas IFGain:Lo	t 🕞 Trig: Free Run w #Atten: 16 dB	Avg Hold:>100/100	TYPE A WWWWW DET A NNNNN	NextPea
10 dB/div	Ref Offset 9.2 Ref 23.23 (Mkr	1 7.313 06 GHz -54.274 dBm	NextFea
13.2	e 1 Pass					Next Pk Righ
-6.77						Next Pk Lef
36.8	2					Marker Delta
46.8 56.8	L					Mkr→Cf
Start 1.0 #Res BW	/ 1.0 MHz	#\ ×	/BW 3.0 MHz*	Sweep 46.6	Stop 26.00 GHz 67 ms (100000 pts)	Mkr→RefLv
MRR MODE 1 N 2 N 3 4 5 6	RC SCL 1 f 1 f	x 7.313 06 GHz 2.320 76 GHz	-54.274 dBm -43.150 dBm			More 1 of 2
۲ ISG			m	STATUS	•	

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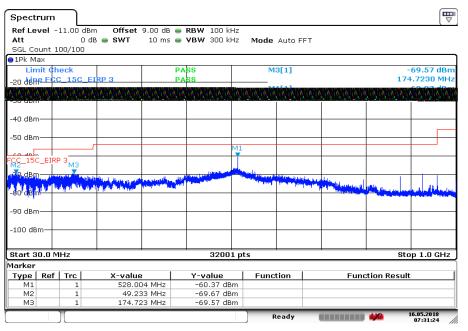


- Keysigl		m Analyzer - S									
<mark>¤</mark> Marke		RF 50	198992			E:INT		ALIGN AUTO	TRAC	Apr 09, 2018 E 1 2 3 4 5 6	Recall State
PASS		NFE PN0: Fast Trig: Free Run Avg Hold:>100/100 Tree Avg/Hold:>100/100 NFE PN0: Fast #Atten: 16 dB Mkr3 2.319 899 GHz Ref 0ffset 9.23 dB -43.369 dBm -43.369 dBm									
00	race 1					M					Edit Registe Name
6.77 -											Registe Last: 4/9/20 2:16:20
26.8				↓	3	Д	Q ²	¢ ⁵			Registe Last: 4/4/20 1:22:33
56.8 66.8	seal and a										Registe Last: 4/4/20 1:23:10
Res E	2.0000 BW 1.0	MHz	×	#VB	W 3.0 MHz*	FUN		Sweep 6.6	67 ms (10	8000 GHz 0000 pts) DNVALUE	Registe Last: 4/9/20 2:16:51
1 N 2 N 3 N 4 N 5 N 6		f f f f	2.483 2.319 2.287	000 GHz 500 GHz 899 GHz 923 GHz 926 GHz	-44.685 dBı -44.286 dBı -43.347 dBı -47.486 dBı -45.364 dBı	n n n					M 0 1 c
sg 🕕 F	Recaller	State Re	aister 4		m			STATI	e .	•	

Plot 6: Middle channel / 2 GHz to 2.8GHz / Antenna port 1 (Band Edge)



Plot 7: Highest channel / 30MHz to 1GHz / Antenna port 1



Date:16MAY.2018 07:31:23

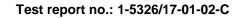
Plot 8: Highest channel / 1GHz to 26GHz / Antenna port

									lyzer - Swe		
Peak Search	PM Apr 09, 2018 CE 1 2 3 4 5 6 PE A WWWWW	TRA	ALIGN AUTO e: RMS :>100/100		NSE:INT		SHZ PNO: Fast	DC 7640 G		RF 2.400	
NextPe	76 GHz	2 2.400	Mkr		6 dB	#Atten: 1	FGain:Low	IF	ffset 9.2	PefC	ASS
	63 dBm	-38.5							23.23 d	Ref	0 dB/div
Next Pk Rig					Ĭ				S	e 1 Pa	13.2
											3.23
Next Pk L											6.77
NEXI FK L											16.8
										2	26.8
Marker De										×1	36.8
										Y	46.8
							-			h	56.8
Mkr→0											66.8
		0 4 (start 1.0
Mkr→RefL	26.00 GHz 00000 pts)		/eep 46.6	5	*	V 3.0 MHz	#VBV		Ηz		Res B
	ION VALUE	FUNCT	ICTION WIDTH	INCTION		Y		Х			IKR MODE
Ma	E					-45.899 di -38.563 di	52 GHz 76 GHz			f f	1 N 2 N 3
1 0											3 4 5
	-					m					6
			STATUS								SG



Keysig	ht Spectru	m Analyzer - S				C 11/C					
<mark>//</mark> Marke	er 1 2.		000000 G			E:INT		ALIGN AUTO Type: RMS old:>100/100	TRAC	Apr 09, 2018 E 1 2 3 4 5 6 E A WWWWW	Recall State
PASS	R	tef Offset 9	.23 dB	NO: Fast ⊊ Gain:Low	#Atten: 16		Avgin		DE 2.319 8		From File
00	Trace 1					~					Edit Registe Names
-6.77 -											Registe Last: 4/9/20 2:16:20 F
26.8				4	3-0	J	Q2	5			Registe Last: 4/4/20 1:22:33
56.8 											Registe Last: 4/4/20 1:23:10
Res I	2.0000 BW 1.0 Denirgie	0 MHz	X		₩ 3.0 MHz*			Sweep 6.6	67 ms (10	8000 GHz 0000 pts) DNVALUE	Registe Last: 4/9/20 2:16:51
1 N 2 N 3 N 4 N 5 N		f f f f	2.390 00 2.483 50 2.319 89 2.287 92 2.559 92	0 GHz 9 GHz 3 GHz	-45.771 dB -45.247 dB -43.604 dB -46.445 dB -45.691 dB	n n n					M d 1 d
sg 🕕 F	Recaller	d State Re	aister 4		m			STATU	s	•	

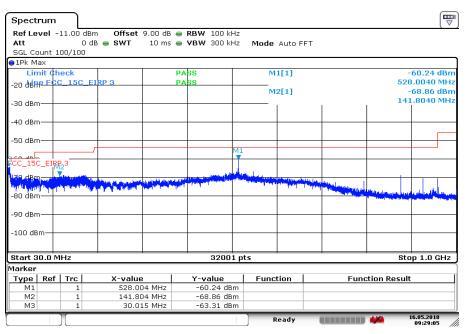
Plot 9: Highest channel / 2 GHz to 2.8GHz / Antenna port 1 (Band Edge)





Plots: OFDM / n40 - mode

Plot 1: Lowest channel / 30MHz to 1GHz / Antenna port 1



Date:16MAY.2018 09:29:05

Plot 2: Lowest channel / 1GHz to 26GHz / Antenna port 1

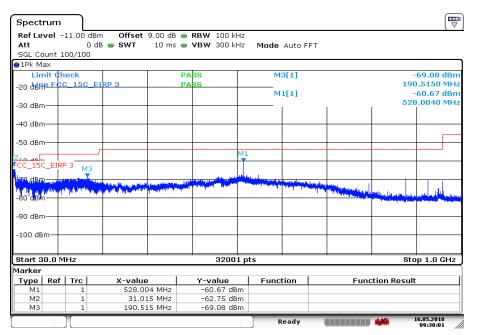




Keysi	ght Spec	trum Analyzer - S				-				
a Cente	er Fr	RF 50 eq 2.4000	Ω DC 000000 GH	z	SENSE:IN	#Avg	ALIGN AUTO Type: RMS	08:35:08 AM Apr TRACE 1	23456	Recall State
PASS	;	Ref Offset 9	IFG	lO: Fast ⊆ ain:Low	Trig: Free Run #Atten: 16 dB	Avg I	Hold:>100/100 Mkr3	DET A		From File
10 dB/		Ref 23.23			V			-44.064	dBm	
13.2	Trace	1 Pass								EditRegiste
3.23 -										Name
6.77			_							
16.8										Registe
26.8										Last: 4/9/20 2:16:20
36.8			_	(⁴ •	3∕	2	5			
46.8 -		1.11								Registe
-56.8										Last: 4/4/20 1:22:33
66.8 -										
		00 GHz 1.0 MHz		#3/DW	/ 3.0 MHz*		O	Stop 2.800		Registe Last: 4/4/20
				#VBV	7 3.0 IVIHZ"		•	67 ms (10000		Last: 4/4/20 1:23:10
1 N		f	× 2.390 000		-43.306 dBm	FUNCTION	FUNCTION WIDTH	FUNCTION VA		
2 N		f	2.483 500 2.319 899		-47.931 dBm -44.057 dBm				- 1	Registe Last: 4/9/20
4 N 5 N		f	2.287 923		-44.675 dBm -45.172 dBm				=	2:16:51 I
6			2.000 020	- Chill	40.112 0.011					
8 9										Mo
10										1 0
11 ∢ [III				• •	
ISG 🚺		led State Re	-1-1-1 4				STATU			

Plot 3: Lowest channel / 2 GHz to 2.8GHz / Antenna port 1 (Band Edge)

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Plot 4: Middle channel / 30MHz to 1GHz / Antenna port 1

Plot 5: Middle channel / 1GHz to 26GHz / Antenna port 1

									- Swept SA			sight Sp	Keys
Marker	4 Apr 09, 2018 E 1 2 3 4 5 6	TRAC		#Avg Ty	NSE:INT			c	0Ω DC	:F 5	F		
Select Marker	NFE PNO: Fast Tig: Free Run Avg Hold:>100/100 TYPE A WWWWWW IFGain:Low #Atten: 16 dB DET A NNNN									S	AS		
2									19.23 dE 1 3 dBm			3/div	0 dB
Norma										Pass	ce 1	Trac	13.2
								_					3.23
Delt													6.77 - 16.8 -
Fixed											1		26.8 36.8 -
Fixed													46.8
O									~~~~	~~~	1	للمس	56.8
													56.8
Properties	6.00 GH z 0000 pts)	Stop 2 7 ms (10	veep 46.6	s	*	3.0 MHz	#VBV			lz MHz	0 GH / 1.0		
	DN VALUE	FUNCTION	ICTION WIDTH	ICTION F		Y -43.451 d	GHz	× 2.320 7			rrc so 1 f	NODE T	1
Mor 1 of													2 3 4 5
	•					III							6
			STATUS										G



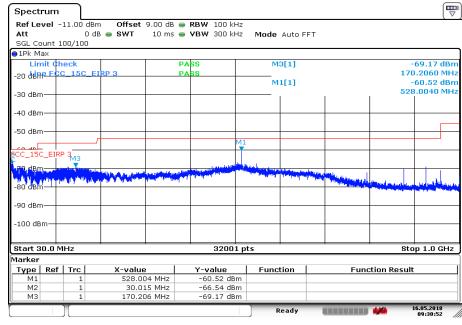
Date:16MAY.2018 09:30:01



	02:25:55 PM Apr 09, 2018	ALIGN AUTO	SENSE:INT	1	rm Analyzer - Swept SA RF 50 Ω DC	Keysight Spect
Peak Search	TRACE 1 2 3 4 5 6 TYPE A WWWW	#Avg Type: RMS Avg Hold:>100/100	Trig: Free Run		560109601096	arker 5 2
NextPea	2.560 110 GHz		#Atten: 16 dB	PNO: Fast ⊂ IFGain:Low	NFE Ref Offset 9.23 dB	ASS
	-45.737 dBm				Ref 23.23 dBm	
Next Pk Rig			¥		l Pass	3.2 Trace
	·					.23
New Obl						.77
Next Pk Lo						6.8
			+			6.8
Marker De		2 <u>5</u>	√ ³			6.8
				- Y		6.8
Mkr→						6.8
						6.8
	Stop 2.8000 GHz	0		<i>4</i> 9 (B)		tart 2.000
Mkr→RefL	67 ms (100000 pts)	•	W 3.0 MHz*			Res BW 1
	FUNCTION VALUE	ION FONCTION WIDTH	-43.679 dBm -44.201 dBm	390 000 GHz 483 500 GHz	f 2.39	1 N 1 2 N 1
Mo			-44.201 dBm -43.543 dBm -45.682 dBm	320 107 GHz 288 227 GHz	f 2.32	2 N 1 3 N 1 4 N 1
1 0	-		-45.686 dBm	560 110 GHz		5 N 1
	•	STATUS	m			g l

Plot 6: Middle channel / 2 GHz to 2.8GHz / Antenna port 1 (Band Edge)

Test report no.: 1-5326/17-01-02-C



Date:16MAY.2018 09:30:51

Plot 8: Highest channel / 1GHz to 26GHz / Antenna port

	ectrum Analyzer - Sv						- 6 2
	RF 50 3		PNO: Fast	SENSE:INT	#Avg Type: RMS Avg Hold:>100/100	02:30:46 PM Apr 09, 2018 TRACE 1 2 3 4 5 6 TYPE A WWWWW DET A N N N N N	Peak Search
ASS	Ref Offset 9	02 40	IFGain:Low	#Atten: 16 dB	Mkr	2 2.400 76 GHz	Next Pea
0 dB/div	Ref 23.23					-39.507 dBm	
13.2 Trac	e 1 Pass						Next Pk Rig
3.23							
6.77							Next Pk Le
16.8							NEXI PK L
26.8							
6.8	1						Marker De
16.8	V						
56.8	Lamon						Mkr→0
6.8							
L	GHz					Stop 26.00 GHz	
Res BW	1.0 MHz		#VB	N 3.0 MHz*	Sweep 46.	67 ms (100000 pts)	Mkr→Refl
KR MODE TR	RC SCL	× 2.5	60 77 GHz	-45.844 dBm	UNCTION FUNCTION WIDTH	FUNCTION VALUE	
2 N 1 3	f	2.4	00 76 GHz	-39.507 dBm		E.	Mo
4 5							1 0
				III	1		
G					STATU	5	

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	02:29:31 PM Apr 09, 2018	ALIGN AUTO	7	SENSE:IN			um Analyzer - S	sight Spectru	Key		
Peak Search	TRACE 1 2 3 4 5 6 TYPE A WWWW	Type: RMS lold:>100/100	#A	Trig: Free Run		001400		(er 6 2.	/arl		
Next Pea	2.400 140 GHz	Mkr6 2.400 140 GHz			PNO: Fast G IFGain:Low		Ref Offset 9.23 dl				
	-39.298 dBm					3 dBm			10 dE		
Next Pk Rig							1 Pass	Trace 1	13.2		
									3.23		
Next Pk L									6.77		
MCATT K E									16.8		
				A6					26.8		
Marker De		5	2	3					36.8		
			- \ <u>`</u>	97					46.8		
Mkr→0							ang nana lalamata	and the local division of the local divisio division of the local division of the local	56.8		
									66.8		
Mkr→RefL	Stop 2.8000 GHz 7 ms (100000 pts)	Sweep 6.66		3.0 MHz*	#VBV			t 2.0000 s BW 1.0			
		FUNCTION WIDTH	FUNCTION	Y -49.725 dBm	0 000 GHz	X 2 300	SCL				
Mo	E			-44.893 dBm -44.187 dBm	3 500 GHz 9 899 GHz	2.483	f f	N 1 N 1	2 3		
1 o				-44.472 dBm -46.223 dBm -39 317 dBm	7 923 GHz 9 926 GHz 1 40 GHz	2.559	f f f	N 1	4 5		
	Þ	STATUS		m					sg		

Plot 9: Highest channel / 2 GHz to 2.8GHz / Antenna port 1 (Band Edge)



12.8 Emissions in restricted frequency bands above 1 GHz (radiated)

Note:

This section of the report only contains results as part of a single frequency verification in addition to the results stated in 12.7.

Neither power setting, data rate, or channel have a significant impact to the measurement results at 2288 MHz and 2320 MHz, hence there is only one plot reported per antenna setup.

Description:

The DTS rules specify that emissions which fall into restricted frequency bands shall comply with the general radiated emission limits.

Measurement:

Measurement parameter							
Detector	Peak / RMS						
Sweep time	Auto						
Resolution bandwidth	1 MHz						
Video bandwidth	3x RBW						
Span	9 kHz to 26 GHz						
Trace mode	Max Hold / Trace Average						
Measured modulation	 ☑ DSSS b – mode □ OFDM g – mode ☑ OFDM n HT20 – mode ☑ OFDM n HT40 – mode 						
Test setup	See chapter 6.1 - A						
Measurement uncertainty	See chapter 8						

Limits:

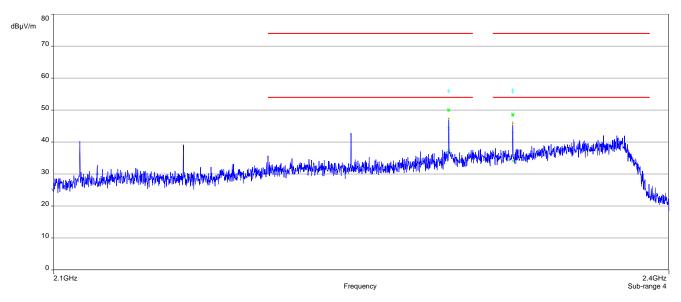
FCC			IC	
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulate intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 30 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desire power, based on either an RF conducted or a radiated measurement. Attenuation below the general limit specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (se §15.205(c)).			r shall be e desired ral limits d bands,	

Frequency / MHz	Field Strength / (dBµV / m)	Measurement distance / m	
Above 960	54.0 (AVG)	3	
	74.0 (Peak)	3	

Results: ANT-DIR-2459-01, single-chain, antenna 2

TX spurious emissions radiated / dBµV/m @ 3 m			
f / MHz	Detector	Level / dBµV/m	
2200	Peak	56.2	
2288	AVG	50.1	
2320	Peak	56.5	
2320	AVG	48.7	

Plot:

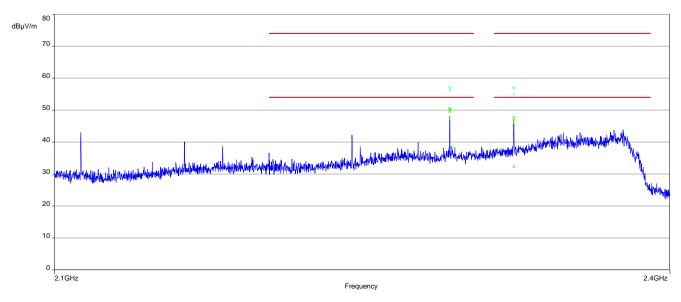




Results: RAD-ISM-2400-ANT-OMNI-6-0, dual-chain, antenna 0&1

TX spurious emissions radiated / dBµV/m @ 3 m			
f / MHz	Detector	Level / dBµV/m	
2288	Peak	57.1	
2288	AVG	50.4	
2320	Peak	57.1	
2320	AVG	47.7	

Plot:

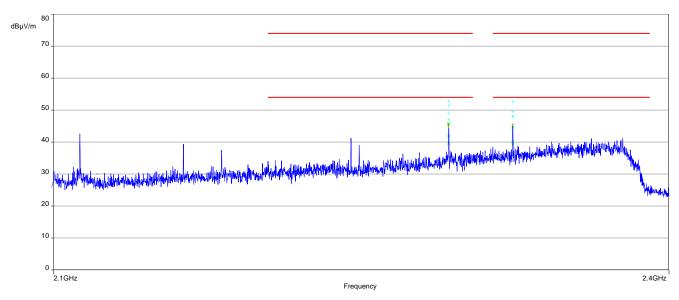




Results: RAD-ISM-2400-ANT-VAN-3-0-RSMA, dual-chain, antenna 0&1

TX spurious emissions radiated / dBµV/m @ 3 m			
f / MHz	Detector	Level / dBµV/m	
2200	Peak	52.9	
2288	AVG	45.4	
2320	Peak	52.6	
2320	AVG	44.6	

Plot:





12.9 Emissions in restricted bands / Cabinet radiation

Compliant as per Module Report F161629E1_2ndVersion.

12.10 Emissions in non-restricted frequency bands

Compliant as per Module Report F161629E1_2ndVersion.

13 Observations

No observations except those reported with the single test cases have been made.

Test report no.: 1-5326/17-01-02-C



Annex A Glossary

EUT	Equipment under test
DUT	Device under test
UUT	Unit under test
FCC	Federal Communications Commission
FCC ID	Company Identifier at FCC
IC	Industry Canada
PMN	Product marketing name
HMN	Host marketing name
HVIN	Hardware version identification number
FVIN	Firmware version identification number
EMC	Electromagnetic Compatibility
HW	Hardware
SW	Software
Inv. No.	Inventory number
S/N or SN	Serial number
С	Compliant
NC	Not compliant
NA	Not applicable
NP	Not performed
PP	Positive peak
QP	Quasi peak
AVG	Average
00	Operating channel
OCW	Operating channel bandwidth
OBW	Occupied bandwidth
OOB	Out of band
DC	Duty cycle
PER	Packet error rate
CW	Clean wave
MC	Modulated carrier
WLAN	Wireless local area network
RLAN	Radio local area network
DSSS	Dynamic sequence spread spectrum
OFDM	Orthogonal frequency division multiplexing



Annex B Document history

Version	Applied changes	Date of release
-/-	Initial release	2018-05-18
А	Applicant, Manufacturer, FVIN, HVIN, HMN and type identification changed	2018-05-24
В	FVIN, HVIN, HMN changed	2018-07-06
С	HVIN revised	2018-08-24

Annex C Accreditation Certificate

first page	last page
Deutsche Akkreditierungsstelle GmbH Entrusted acording to Section 8 subsection 1 AkkStelleG in connection with Section 1 subsection 1 AkkStelleGBV Signatory to the Multilateral Agreements of EA, ILAC and IAF for Mutual Recognition	Deutsche Akkreditierungsstelle GmbH Office Barlin Spittelmarkt 10 10117 Berlin Office Frankfurt am Main Bundesallee 100 38116 Braunschweig Spittelmarkt 10
The Deutsche Akkreditierungsstelle GmbH attests that the testing laboratory CTC advanced GmbH Untertürkheimer Straße 6-10, 66117 Saarbrücken is competent under the terms of DIN EN ISO/IEC 17025:2005 to carry out tests in the following fields: Telecommunication	The publication of extracts of the accreditation certificate is subject to the prior written approval by Deutsche Akrediterungsstelle GmbH (DAKAS). Exempted is the unchanged form of separate disseminations of the cover sheet by the conformity assessment body mentioned overleaf.
The accreditation certificate shall only apply in connection with the notice of accreditation of 02.06.2017 with the accreditation number D-PI-12076-01 and is valid uml 21.04.2021. It comprises the cover sheet, the reverse side of the cover sheet and the following annex with a total of 43 pages. Registration number of the certificate: D-PI-12076-01-03	No impression shall be made that the accreditation also extends to fields beyond the scope of accreditation attested by DAkkS. The accreditation was granted pursuant to the Act on the Accreditation Body (AkStelleG) of 31 July 2009 (Fideral Tau Gaztete J., 2625) and the Regulation (EC) No 5672008 of the European Parliament and of the Council of 3 July 2008 setting out the requirements for accreditation and market surveillance relating to the marketing of products (Official Journal of the European Inton 1218 of 3 July 2008, p. 30). DAkKS is a signatory to the Multilateral Agreements for Mutual Recognition of the European Co-operation for Accreditation (E(A), International Accreditation Forum (IAF) and International Laboratory Accreditation Cooperation (ILAC). The signatories to these agreements recognise each other's accreditations. The up-to-date state of membership can be retrieved from the following websites: EA: www.uaropean-accreditation.org ILAC: www.iaf.nu
Frankfurt, 02.06.2017 Dief vice (FH) Roll Scher Helli of Division Secons contrat.	

Note: The current certificate annex is published on the website (link see below) of the Accreditation Body DAkkS or may be received by CTC advanced GmbH on request

http://www.dakks.de/as/ast/d/D-PL-12076-01-03.pdf